Multi-Layer System of Urban Open Space — Study in Montreal

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Abstract
Montreal’s basic structures of metro and underground city were built in the 1960s. Their spaces are well used today as an essential part of the city. Montreal’s urban open space (UOS) is full of rich and diverse artworks. It makes the city become the famous ‘art capital’ after almost six decades. Major art works are created by famous local-artists, spontaneous fresh-artists or amateur artists. However, these spaces were not vitality urban space without professional reorganized for whole UOS network after 2003. The multi-layer system offers the basic framework for the network of UOS in the process of rehabilitation. Each layer is a reference to the influence of a different scope of people. All kinds of UOS for different layers cooperate to work as the whole network, which encourages the public to engage in. This study takes Place des Arts as an example because of it is the special case, which is a UOS make efforts in all layers of the social cohesion. In this paper, the UOS of Place des Arts area is analysed and interpreted according to the characteristics and attributions in every layer. Moreover, it discusses how the UOS drew general people involving in bottom-up designing for it. At last the strategies of the multi-layer system in Place des Arts are summarized as considering as the efficient procedures for keeping people participate in the vital phenomenon of UOS positively. That plays a vital role in improving adaptability and resilience of UOS.

1. Introduction
The requirements for social activities and optional activities [5] in urban open space (UOS) are increasing rapidly with the acceleration of contemporary society. In order to achieve the efficiency and convenient cities without demolition of too many buildings for rebuilt, how to build dynamic spaces in inner cities became a very important proposition. The Place des Arts, as a successful case of recovering vibrancy UOS after reusing in Montreal, is studied in this paper. Most of the fundamental construction was built in 1960s. The beginning infill content was not as good as nowadays mainly because of the government was lack of money to maintain the constructions after getting the massive debt from the 1967 Expo the 1976 Olympic [9]. And the downturn economic was also influenced by the frustration of Quebec referendum in 1980s and 1990s. However, now these UOS have been full of vibrancy activities and events. They are used softly and flexibly in diverse ways. And it is the inclusiveness character of UOS leads Montreal to be the famous New-art and design city. Therefore, this paper aims to interpret the strategies of multi-layer system by analysing the comprehensive case: Place des Arts.

2. Background
The first underground city was developed in 1962 beside the south of the Royal Mountain. The underground city named Place Ville-Marie including 500,000 square meters. After Montreal prepared to held the 1976 Olympic, the underground city starts its high-speed development period [1]. Four underground commercial corridors were constructed. Most parts of them are under the subway lines. In the 1990s, the underground public space has been a considerable system linked to the diverse regional activities. The biggest underground city in the world became a reality at that time [8]. The underground UOS let people avoid the terrible weather.
outside both in frozen winter and humid summer. The underground city connects to 60 buildings directly. Its tunnels cover more than 32 kilometers and 12 square kilometers. It services to shopping mall, hotels, offices and museums, etc. There, are about 80% offices area and 35% commercial area included in this service area. The underground city directly covers 7 metro stations, 2 railway stations, 1 long-distance bus terminal and the Bell Center (Figure 1). And there are more than 200 metro enters lead a tight combine between the up-ground city and the underground city.

Place des Art actually is one piece of the whole Montreal’s UOS system. The whole system in the inner city is called Quartier des Spectacles after re-managed in 2003. Three central subway stations are involved: Place Des Art, Station Saint-Lauren and Station Berri-UQAM, The history of different stratum around Place des Arts can be traced back to the 19th century. In 1800s, the new Collège Sainte-Marie was built with Bibliothèque Saint-Sulpice moved to here. Then, in 1865, the Gesù theatre achieved in its opening. It leads to a number of theaters, art galleries and other cultural facilities has been widely established, such as the Gayety Theatre, Théâtre Saint-Denis and the Imperial Cinema, etc. And the achievements of these cultural facilities also attracted a lot of artists and performers gathered here. Gradually the Montreal received a reputation about hedonism.

In the 1950s, the recreational activities developed to be gradually specialization. After it experienced the unprecedented modernization in 1960. New government starts to develop the construction of Place des Arts. In the later decade, the venues for performing were constructed fast in Montreal. The usual empty small locations in the city are also becoming the link points for UOS network. The blend and flourish culture atmosphere is also what the new generation artists are admiring. The continue import of talent resources helps the healthy growth of urban vitality, which is the intrinsic motivation of UOS development.

3. Research method

3.1. Layers of urban open space

Since the second half of 19th century, several urban theories about improving public environment were proposed, such as Garden City, comprehensive planning and exploring on naturalism, etc. After the 1960s, propositions for ecological protection, heritage, and landscape protection were increasing. Moreover, relevant theories and methods were applied in urban planning and design [4]. Since the 1960s, the protection practice expanded from cultural heritage to the historical area. After some protecting practices in France, some international regulatory documents were issued, such as Convention for The Protection of World Cultural and Natural Heritage in 1972 and Washington Charter in 1987, etc. At the same time, urban open space with historical value was gradually getting considerable attention from people. These places get protection and restoration. Not only the cultural heritage but also the area has high visual value was protected and adopt in urban planning. This period is also the fastest development time for UOS in Montreal. Huge constructions were built for improving the possibility of flexible use by influencing the theory of Archigram. The famous book: Mega-structure about the development of Montreal’s urban facilities in that period is also representative writing of that trend.

Several ideas about urban space in the 1960s were accepted widely, including Archigram considered that separation of infill and integrated structure could help to achieve the flexibility and openness of urban facilities. Moreover, Metabolism pointed that renewal of construction itself is the key to make the design adapt to the social transformation. It emphasizes the influence of the participants, users and public, such as Jan Gehl emphasized the public activities in Life Between Buildings, Christopher Alexander emphasized people’s visual can influence the urban open space in A Pattern Language, Kelvin Linch emphasized that identification of places in people’s mind in City Image and Yoshinobu Ashihara emphasize the rhythm and dimension of The Aesthetic Townscape, etc. This paper developed the research mainly reference to the theory of Open Building, which combined the three ideas during that period: (1) using layer system to improving flexibility of building; (2) caring about the renewing and updating of separate parts; (3) emphasizing the reflection of diversity behaviours to space design. At early time, the theory of Open Building was focusing on the practices of housing [10]. Nowadays, with the three concepts were widely accept, his idea about layers can also help the construction of public facilities [7]. This paper considers the urban open space can also be divided into five layers.
for achieving three goals for a beautiful place. The five layers are a city, district, neighbour, block, and plot.

3.2. Attributions in every layer

Since the 1960s, people begin to pay attention to the multiple values or multiple attributions of the built environment. Moreover, many attentions are about public participation, maintenance of public places and conservation. The attributions of space are the essential things what people want to enjoy rather than the physical construction itself, especially for the significant scale ones. The diverse attributions of UOS is the key which is widely discussed in urban design and planning field [4]. These spaces can be evaluated by assessing their attributions. In this study, the UOS in every layer is also analysed and interpreted by the three parts: public resources, ownership domain, and UOS realm, which is inspired from the urban design theories, such as the C. Webster discussed in his articles [11].

Public resources refer to all resources for public consumption in one urban open space. These resources include the physical space with all tangible facilities and intangible services in it [12]. Second, ownership domain of UOS refers to the management and control ways for UOS. At most time, the ownership of space tends to affect the management permanently. Third, the UOS realm refers to the scope of the public can reach. It is a scope of physical area. In contemporary urban, a lot of public-own spaces and private-own spaces are connected for public use. The public realm is no longer just on the edges of public places as the official document shows. Therefore, this study inspects the three main factors of Place des Arts and surroundings: activities and gates of access, ownership and management strategies, space pattern and situation of inside or outside.

4. Case analysis

4.1. Layer one – City: Soft integration of old and new

After the 1960s, most large constructions are completed in Montreal. People pay more efforts on improving the culture image of these basic structures. The soft integration methods were used widely for diversified urban spaces. Benefit from the fast modern information dissemination, the image of Place des Arts was established all around the city. With relevant art institutions were continuously improved, the propaganda of its image was also being optimized. The people live far away can also understand and cognize the vital image of this place. Furthermore, They desire to come and take participate in it.

The space in this layer refers to the activity place for people all around the city. With the help of information technology, these spaces can attract and contain more people as the root of its vigor continuously. It is physical spaces related to the information connection or virtual reality. It is not only the virtual society on the Internet or the one-way information dissemination from the space to the public. For this layer, the meaning of a place for space is the information flowing and growing between people and space bidirectional. In this process, the information technology provides help for bigger influence, which can hardly be reached decades ago.

People in the specific physical space not only communicate with other people but also with the UOS. The general people start to interact and contribute to the UOS. For example, people who walk into the scope of a place will receive the notification about arts finding in the place. Information can exchange rapidly and fast between people about the environment. People record the exciting parts of events in the space, which also will be uploaded and shown in the media, which are located in the space. This action undoubtedly influences and improves the space attraction and phenomenon a lot. At this layer, both communications between people and interaction between people and built environment lead the achievement of the beautiful public place. (Figure 2) It is much better, and affection than a place sends limit information to the public endless. The redesign of Place des Arts is doubtless an excellent example for bringing activities and building a beautiful image in the whole city layer.

![Information Flowing Diagram](image-url)
4.2. Layer two – District: Assemblage of lines and spots

In Montreal, regular Festival events have been hosted for 12 years, such as Nuit Blanche. These activities happened in 3 districts, which connect eight neighbourhoods. At one time, more than 200 activities courage people to participate in the city’s arts. Most of them are free. It can get 350,000 visits in a matter of hours. The events improve the publicness of the space. People take participate in the events by two ways of transport: walking on the ground or taking metro underground. The two kinds of transport connect various energy UOS (left part of Figure 3). The blue dashed line is the primary path following Boulevard René-Lévesque in the south and Rue Sherbrooke in the north. Moreover, the two paths extend to Canadian Centre for Architecture, Berri-UQAM, and Parc La Fontaine. That makes a complete circle for the whole area. The loop enlarges the influence area of Place des Arts. The evacuation is improved by the circle completes. The key to maintaining the stability and tension of this loop is the Rue Sainte-Catherine, which is parallel to the two paths. This street is the earliest commercial one in Montreal. Since 1801, several universities, famous hotels, and cultural centres were established around it. It goes across the core area of Place des Arts and Complexe Desjardins.

At the same time, two subway lines connect east and west parts with about 50 metro entrances (right part of Figure 3). Therefore, in these district people can reach everywhere by walking on the ground. The parking problems are avoided. Parking space is all used for people activities and communication area. The most important the vivid phenomenon does not gradually decay as circles around the Places des Arts but spread to universities, churches, and malls from the central spine Rue Sainte-Catherine, which is controlled by Place des Arts. The convenient underground walking streets is also an excellent choice for people to wander to anywhere in this area with suffering the extreme cold weather outside, besides subway. The underground streets are not simple corridors but connected to the main entrance of commercial buildings, universities, and museums. Countless pieces of original independent up-ground and underground UOS are assembled as a dynamic and vibrant integrated system all around the year.

4.3. Layer three – Neighbour: Synchronous development

Since the 1860s, the art atmosphere began gradually formed in Place des Arts. Since the 1960s, Place des Arts, Place des Festival, and the other neighbours are linked closely to each other. In usual days, cars go through the Catherine Street. Underground connections can make sure the close relationship would not be cut off by the traffic. Moreover, these connections look like that usual...
ground walking streets are moved to underground. Moreover, the underground street is built large enough as plazas with many entrances to all institutions around. These underground entrances for buildings are usually the main entrances for pedestrian rather than side doors. The publicity of underground space is as well as ground ones. Moreover, these spaces are accessible to public population 24 hours. Both safety monitoring management and art design are strengthened in the underground floor. The irregular space is filled with various arts with special lights. The underground floor seems much more like the ground avenue in warmer cities with long-last vitality with the ground floor is playing a role of roof plaza for temporary activities. Because the climate is very cold in winter from October to April, it is hard for people to walk individually in the outside plaza. Almost all pedestrians rely on the underground space in this period. The transition space with sufficient capacity paste Place des Arts with other neighbourhood firmly. This is achieved by multiple connections as lines rather than point connections.

The orange parts in the figure show that underground space works as an octopus stretches its legs to multiple angles and grasps surroundings. (Figure 4) The underground space plays an outstanding role in adhering adjacent neighbourhood, especially in event days, such as Festival International de Jazz de Montréal and Nuit Blanche à Montréal. The whole area will be exclusive for vehicles. Street space is also returned to public people while the multi-connections show a tension with the whole area by offering an alternative active street and plazas in parallel.

4.4. Layer four – Block: Comprehensive of under-ground and up-ground

In Place des Arts, the underground space and the ground space system work at the same time. Multi-directional connection space let people enable to transfer between outdoor and indoor quite easily, fast and independently. Even in the crowded festival period, one primary ground space can accommodate about 40000 persons without congestion. People have no impediments to change their locations fast no matter at the underground or up-ground. The frozen and snowy weather in winter is the most crucial factor prompts the underground open space was built as significant as the ground one. Influenced by the mega-structure theories during the period of the 1960s. As a result, sufficient horizontal and vertical scale make people can gather together in the underground space without attacking by cold winds. The height above rails is more than 24 meters. Another extraordinary character of the underground floors is that people can see the natural lighting on every floor, even the second or third underground floor. (Figure 5) With the natural lighting, the greening, fountain, and seats on the public square underground work as same as the ground avenue. Moreover, the inlet windows are designed by considering the ground landscape features. By this way, it is more than just moving the ordinary walking street to the underground. When people look through the windows, they feel be encouraged to explore the other side. Attraction and openness of both sides are improved. Underground part works like the regular avenue naturally over the whole year. The ground square and landscape part are used especially with specialized climate. Facilities and equipment are settled temporary or seasonally, for example, the ice slide in winter, strap line in spring and performance stage in summer. During Festival Times, the indoor places are engaged with specific activities gradually. At the last two days of the festival such as Nuit Blanche, the ground traffic would be rechanneled. The whole area is converted to be a playground for the whole city. The flexibility use of the ground square makes the place keep the freshness feeling for local people. It is an efficient way of using city resources in different seasons. The changeable art characters, vast capacity, convenient transportation and comprehensive design of both up and underground contribute Place des Arts to be a great living room of the city.

4.5. Layer five – Plot: Positive bottom-to-up design for UOS

Montreal attracts various artists all over the world to come here for learning new media arts or trying
freedom creations. The containment all kinds of arts offer fair and opportunities for all local and travel artists to make efforts in different size of UOS. And their creation works become the wealthy resource of special vitality. No matter the travel artists with simple musical instrument or professional dancers or famous curators can find suitable space for display. The first underground floor in Place des Arts is not really below the most streets’ plane. It likes a big plaza roof that connects several buildings. And big steps upon the roof are facing to the main street. Therefore, the whole plot is an urban complex implant the ground. Two theatres and one museum are embedded around it. Many small affiliate spaces attached to the main space are formed under the roof. Small pieces are divided for diverse usage. Though the management and provider are different, most of the places and events are free and donated projects for public. Almost all of these events are the optional and social activities. And all of these activities have several artists involved. Some artists are spontaneous while the others are hired by public benefit organization. The Place des Arts is also a great platform for artists publish and test their artworks as a lot of professional artists, amateurs or art lovers walk around here. In other words, the responsibility for the public resources in the complex is divided into a lot of parts. And all kinds of groups can find suitable parts to contribute to. The inclusive for arts is becoming a tradition, that is the most attraction point for art creators to come. And this also inspires a lot of normal public people. A lot of people take participate in a place is also a great attraction for more people come in. The divided and diverse kinds of responsible groups make every corner of the place can be found surprise experience by public. After these efforts, the bottom-to-up design for Place des Arts turned these empty lost corners and walking passageways to be an art gallery and the vitality social core of the city.

5. Conclusion

In Place des Arts, by developing in multi-layer the comprehensive ground and underground UOS is not only providing the convenient transportation but also contributing in several parts. For example, it offers nice locations for commercial shops with comfortable temperature in winter. And the improved facilities let pedestrian can wander and relax at any time. Moreover, sufficient entrances and connections help to reduce the probability of traffic congestion. Additionally, variety formal and informal spaces create a fulfilling social space for public people. And five strategies of developing multi-layer in Place des Arts can be summarized as below.

(1) Multilateral communication

Using the Internet technologies including social software and Website platform to collect diverse requirements and feedbacks about Place des Arts from people all around the city. The meaning of this place becomes a multi-dimensional interactive platform after close links were built between the soft part: information from people and the hard part: building constructions. The regular activities in various scales can keep the cultural tradition as a heritage of the city. By improving the information flowing changes between places and people the goal of making a space with continuous vitality and popularity has been achieved (left part of Figure 6).

(2) Integration of dispersive resource

The Place Des Arts is one of the special points, in Montreal, that has the effects on controlling the tension of three districts. In the UOS network, it is the core connecting to the other important control points (CCA and Berri-UQAM) of the main activity spine: Catherine street (right part of Figure 6). At the same time the walking loop and two subway lines encompass the spine. The close connection relationship of the three routes with different speeds is contributing to integrate the dispersive all kinds of individual UOS pieces to work together easily.

(3) Connection area replaces traditional connection lines

In the cases, it is very prominent that transition space among comprehensive institutions occupies bigger land than the surrounding individual buildings. The fragile and thin traditional line-connection is replaced by the thick and big surface-connection. The surface-connection parts are comprehensive activity squares rather than simple transit passageway. After these efforts, the attraction and service radius of every individual district are improved greatly (Figure 7).

(4) Assemblage of indoor and outdoor UOS

Half of the energy square is inert into indoor space because of the cold weather in winter. And the ground vacation part is built as a special activities square, which has the regional climate characteristics (left part of Figure 8). The collaborative development of underground and ground floors improve the connection between neighbours and buildings. It also provided convenience walking-ways for people in winter. Moreover, the indoor square and special ground square are very regional and impressive for people. These factors contribute to keep the attraction of these places a long time.

(5) Bottom-to-up development

After optimizing the sanitation and basic facilities, more optional activities can happen. The number of improved places for optional activities and social activities are increased. And many people acting in these places drew more people join them. The relax requirements for
(1) Multilateral communication

(2) Integration of dispersive resource

(3) Connection area replaces traditional connection lines

(4) Assemblage of indoor and outdoor

(5) Bottom-to-up development

Figure 6. Conception diagram of strategy 1 and 2

Figure 7. Conception diagram of strategy 3

Figure 8. Conception diagram of strategy 4 and 5

holding events in these spaces also encourages a lot independent creation activities (right part of Figure 8).

The inclusiveness of UOS for all kind of artworks already became a tradition in this city. The bottom-to-up behaviour of hosting public-welfare art activities in UOS is gradually taking the responsibility of leading these informal public spaces to be formal art places. In this process, the negative intervention from public is turned to be the positive parts of urban open space.

To conclude, the multi-level system is an effective method for improving the adaptability of urban open space, especially for the transformation of existing built environment. The strategies for development in every layer are relatively independent. Therefore, the renewal of context in every layer is relative facilitation.
References


