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Analysis of Space Syntax Theory in Studio Bell in Canada

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Abstract

Music and dance center intends to showcase world-class exhibitions and performances using advanced musical technology and innovation to people. This study reviews the space syntax of Studio Bell in Canada, emphasizing the permeability level and wayfinding to study the spatial configurations in depth. This research also studies the spatial connections established between public spaces and administration areas. The overall space syntax findings are analyzed using the alphanumeric system, the Likert Scale, and the justified graph. The findings are interpreted and tabulated in the table for a clearer understanding. The result shows that approximately 51.9 % of the building spaces are semi-private and average in wayfinding due to the limited access for paid visitors to the exhibitions and performance halls. The multiple-way route connects the visitors from a central node space to the branching space, leading visitors to experience a series of exhibitions and performances. The study concludes that public and private spaces are differentiated through the level of permeability and wayfinding. The design can be enhanced by appropriately allocating directional signage to the users. Overall, the building is a satisfactory design with well-zoned.

Discipline: Space Syntax, Spatial Configuration, Architecture

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1 Introduction

In the architecture industry, the technique of analyzing space syntax has been used widely to analyze the spatial cognition aspects of the place such as wayfinding and place-learning (Beck and Turkienicz, 2009). This research paper studies the typology of music and dance center in depth. The

public and spatial configuration of the music center is important to distinguish clear zoning between the visitors (public) and the administration and performers (private). development (Yusoff et al., 2019) Well-planned planning in the center helps achieve the goal of efficiency and equity. (Wolf, J.H., et al, 2021)

The music and dance center typically houses a series of exhibitions and galleries that are well-designed for the public. Similar to the performing art center, the music center usually houses performance halls that are intended for cultural and performing events. (Li, J.M. et al, 2019) The events include musical events, dance events, and sometimes theatre.

Dedicated to the Canadian Music, National Music Centre (NMC) in Canada, Studio Bell is a new cultural institution. The building itself indicates the renaissance of the district, attracting various types of audiences, at both national and international levels to the city. (Studio Bell, n.d) Studio Bell house a series of spaces that are similar to an interactive music education center. The spaces that can be found in the center include an education center, performance halls, a musical museum, recording studios, and a broadcasting center. (National Music of Canada, n.d)

Studio Bell is selected as the case study for this research as the building is interesting in terms of its spatial layout, appearance, and its background. The building space within the entire building is well connected, interconnecting the users from one space to another. Besides. Studio Bell is an award-winning project which obtained a proud achievement by winning the Award of Merit for Azure Magazine AZ in the year 2013. While in the subsequent year, the team won the Progressive Architecture Award. Many more awards were won by the team in the subsequent years. Besides, several publications feature the architecture of Studio Bell. (National Music of Canada, n.d).

This paper attempts to study the level of permeability and wayfinding based on the types of users in the Studio Bell through the spatial configurations within the building. The study of permeability and wayfinding enables us to identify the spatial relationships and the degree of privacy of the spaces within the building. It is expected that various target users will experience different levels of wayfinding and permeability based on the function of the spaces.

2 Literature Review

2.1 Space Syntax

Space syntax theory developed by Bill Hiller and Julienne Hanon circumscribes a set of techniques and theories as a tool to analyze spatial configurations. The spaces include buildings, landscapes, cities, and interior spaces (Hillier & Hanson, 1984). By using the analytical comparative approach, the theory of space syntax enables people to distinguish the level of privacy based on the configurations. (Mustafa, F.A. et al, 2010) Besides, the tool can identify how the spaces are arranged and experienced by the people which can carry cultural and social significance. (Dursun, 2007) (Abrams, J. B. , 2010) The spatial configuration and the layout will influence the way how an individual utilized them. (Hassan, 2004)

Space syntax has a significant focus on the networking between spaces. The practice of studying the connectivity between the spaces requires a graphical representation of the spatial organization. It can be examined and analyzed through the graphs of analysis such as justified graphs and syntactic steps. (Klarqvist, 1993) The level of permeability will be obtained. The results show the peoples' opinion in satisfaction of the spaces based on the properties of that certain space. (Yavus et al., 2012)

2.2 Background of the Case Study

Studio Bell Music Centre is a recent cultural project designed by Allied Work Architecture (AWA). The components within the building consist of a performance hall, recording facilities, broadcast studios, a live music venue, and a museum, which has a total area of 160,000 square feet. The project includes a 300-seat performance hall and exhibition space with a total of 22,000 square feet. "King Eddy", the masonry building was refurbished and integrated within the newly built Studio Bell's west block. The programs in the center feature a radio station, recording studios, a media center, Artists-in-Residence spaces, and education classrooms.

The building has mixed components that include commercial, museum, and education. The overall spatial design of the building is semi-private due to its limited access to paid visitors. The Studio Bell Music Centre is proudly located in Calgary, Alberta. It is at the site of the legendary blues club in the historic King Edward Hotel. With the live performance, special exhibitions, and interactive educational programs happening in the Studio Bell Music Centre, the connection between the visitors and Canadian musical history can be established. The building is designed as postmodern architecture.

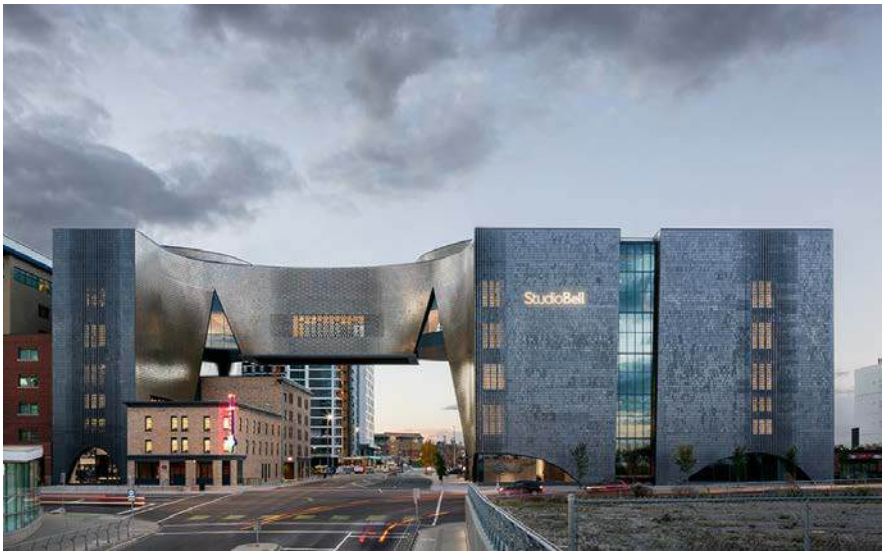

Figure 1: Exterior of Studio Bell, Canada (Photo courtesy of Archdaily)

3 Method

Preliminary research is conducted through quantitative research methods such as journals, articles, and internet research. An overseas site visit is not encouraged to be done by the authors due to the Covid-19 pandemic outbreak. By obtaining the data from online sources, the spatial

arrangements on floor plans can be observed. The analysis of permeability and wayfinding at the studio can be done. Next, the analysis of the case study is done by observing the spatial networking using the measurable scale graph, and examining the spatial hierarchies through the leveling system in the numbering graph (Yusoff et al., 2019). The level of permeability and wayfinding in Studio Bell Music Center is presented in graphical form. The results are then analyzed based on the users' categories.

3.1 Alphanumeric System

The table below shows the alphanumeric system that is used to differentiate different functions of space. Different color with the alphabet symbolizes different building functions. The sequence of the numbering indicated the hierarchy of the spaces.

Table 1: Alphanumeric System based on Building Fuction

Funtion	Alphanumeric	Colour
Building Access	E (E1, E2, E3, etc.)	Yellow
Music Exhibitions/Facilities	A (A1, A2, A3, etc)	Orange
Amenities	R (R1, R2, R3, etc)	Pink
Transportation	T (T1,T2,T3, etc)	Red
Services	S (S1, S2, S3, etc)	Grey
Administration	C (C1, C2, C3, etc)	Blue

3.2 Justified Graph

Figure 2 shows the example of a justified graph that will indicate the depth of spaces within the building in a numeric way. The level of permeability and wayfinding is the primary key to developing the space syntax of justified graphs. The justified graph is drawn with the 'root' at the lowest level, branching the 'root' continually in both horizontal and vertical directions. The branching of the nodes will reach its highest number based on the spatial arrangement. A hypothesis says that the higher the numbers, the deeper the spaces. (Lee, 2020)

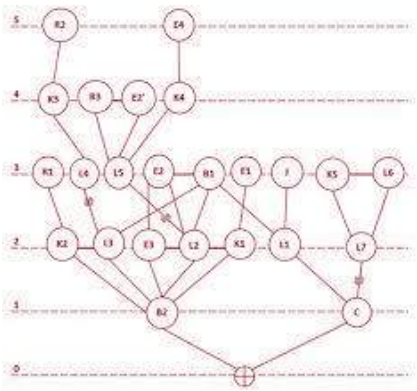

Figure 2: Example of Justified Graph (Lazaridou, 2013)

3.3 Likert Scale

The Likert Scale is used to categorize the type of spaces, ranging from public to extremely private. Each space is rated on the Likert scale shown in the table below. A higher rating of the Likert Scale results in a higher level of permeability.

Table 2: Likert Scale for Space Syntax Analysis

Rating of Likert Scale	Depth of Permeability	Level of Wayfinding
0-4	Public	Very Easy
5	Semi-Public	Easy
6-8	Semi-Private	Average
9-11	Private	Difficult
12	Extremely Private	Very Difficult

4 Result and Discussion

4.1 Overall Justified Graph in Studio Bell, Canada

The overall justified graph is examined based on the four floorplans, which are the site plan, ground floor plan, first-floor plan, and top floor plan. The analysis shows that the visitors follow the exhibition paths while the staffs mainly occupy the administration spaces.

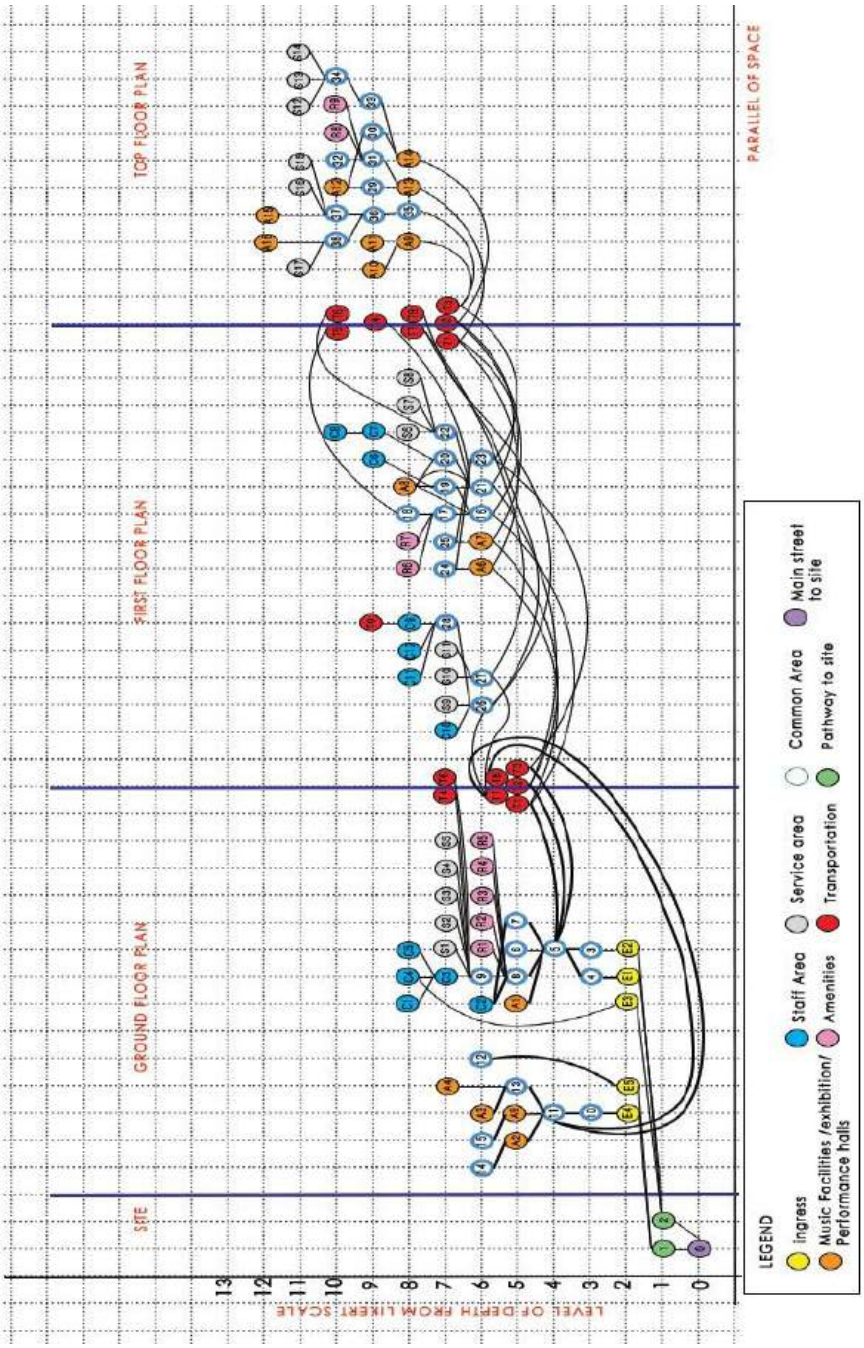

Figure 3: Overall Justified Graph for Studio Bell, Canada

4.2 Analysis of Space Syntax on Site Plan and Ground Floor Plan

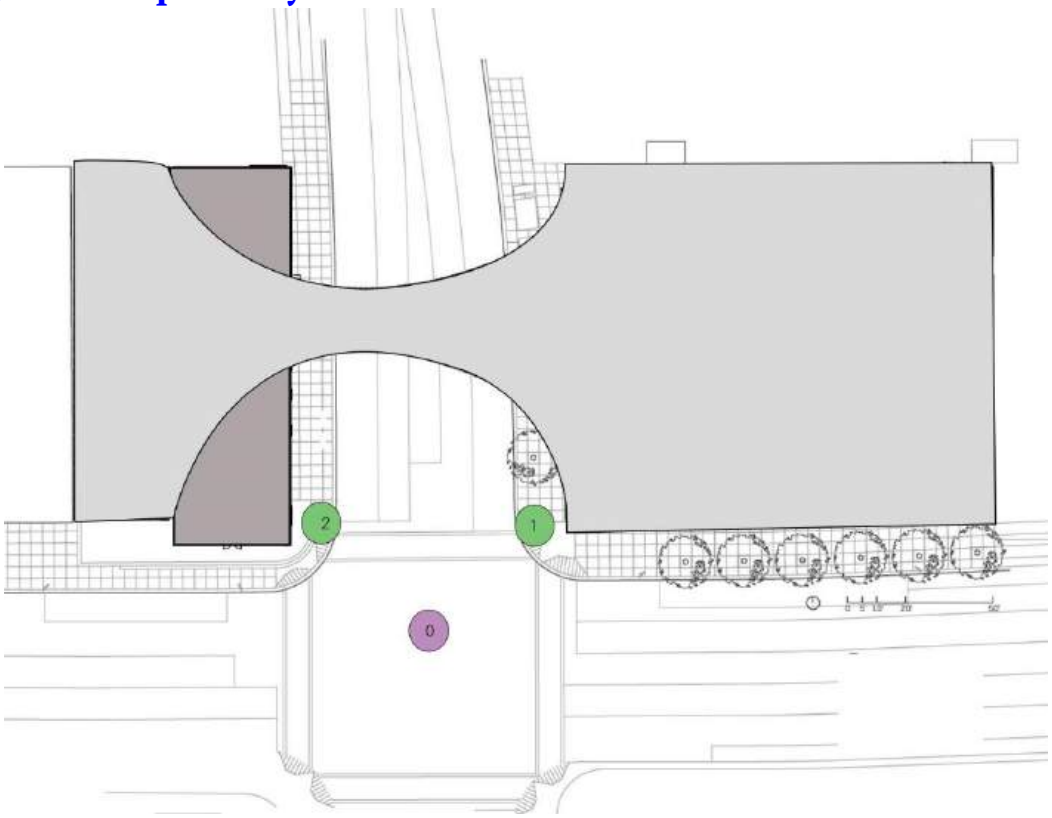

Figure 4: Site Plan with Legend

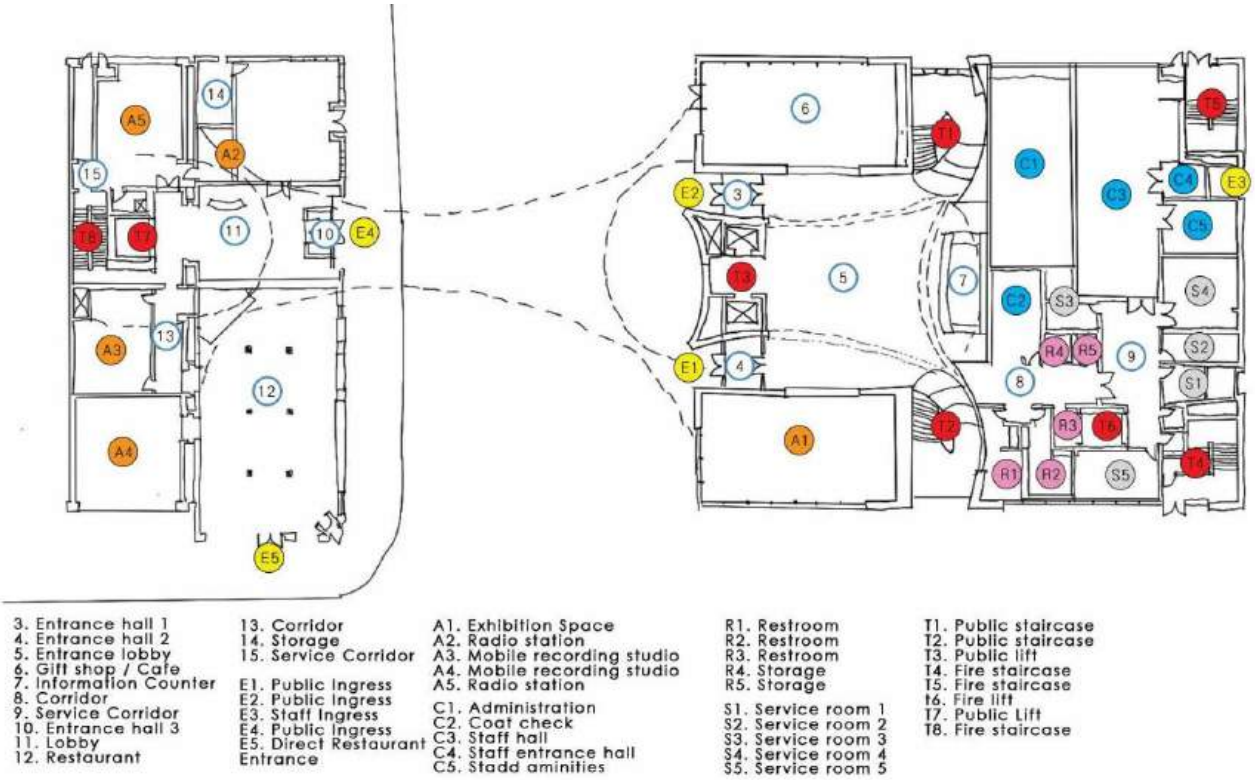

Figure 5: Ground Floor Plan with Legend

In fulfillment with Figures 4 & 5, the building is designed as two towers connected by a bridge on the top floor. The first tower mainly houses exhibitions and galleries for the public while the tower houses recording studios and offices. There are three entrances for the public, namely E1,

E2 & E4. Both entrances (E1 & E2) lead the visitors to the first tower while the entrance (E4) leads the visitors to the second tower, the visitors are welcomed into Studio Bell through a central grand entrance. On the ground floor, there are cafés and exhibitions located on the North and South that can be directly accessed from the lobby. There are two helical staircases (T1&T2) and a lift lobby(T3), playing a role as the primary vertical transportation that takes the visitors to travel up to the main galleries and performance hall. Information counter (C1), coat check (C2) and staff amenities (C3-C5) serve as the administrative management of the building. There is an entrance (E3) enabling the staff to have direct access to the staff amenities. Going into a high-depth level at the ground floor, services lift lobbies (T6) and corridors are provided for the technician to enter the service and mechanical spaces. (S1-S5).

For the second tower, the visitors begin the journey by meeting the grand lobby (11). The visitors have direct access to the radio stations (A2 & A5) and mobile recording studios (A3 & A4) through the corridor. Similar to the first tower, the central lift lobby (T7 & T8) is the vertical transportation that brings the visitors up to the upper floors. There is an entrance enabling pedestrians walking on the street to have direct access (E5) to the restaurant without going through the lobby.

Table 3: Likert Scale on Space Analysis for Ground Floor Plan

Area (First tower)	Category	Depth Level	Level of Permeability	Level of Wayfinding
E1, E2,	Building Entrance	2	Public	Very Easy
3	Common Area	3	Public	Very Easy
4	Common Area	3	Public	Very Easy
5	Common Area	4	Public	Very Easy
7	Common Area	5	Semi-Public	Easy
8	Common Area	5	Semi-Public	Easy
6	Common Area	5	Semi-Public	Easy
T1	Transportation	5	Semi-Public	Easy
T2	Transportation	5	Semi-Public	Easy
T3	Transportation	5	Semi-Public	Easy
A1	Music Facilities	5	Semi-Public	Easy
C2	Administration	6	Semi-Private	Average
9	Common Area	6	Semi-Private	Average
R1, R2, R3, R4, R5	Amenities	6	Semi-Private	Average
C3	Administration	7	Semi- Private	Average
S1, S2, S3, S4, S5	Services	7	Semi- Private	Average
T4	Transportation	7	Semi- Private	Average
C1	Administration	8	Semi- Private	Average
C4	Administration	8	Semi- Private	Average
C5	Administration	8	Semi- Private	Average
Area (Second tower)	Category	Depth Level	Level of Permeability	Level of Wayfinding
E4, E5	Building Entrance	2	Public	Very Easy
10	Common Area	3	Public	Very Easy
12	Common Area	3	Public	Very Easy
11	Common Area	4	Public	Very Easy
13	Common Area	5	Semi-Public	Easy
A2	Music Facilities	5	Semi-Public	Easy
A5	Music Facilities	5	Semi-Public	Easy
T7	Transportation	5	Semi-Public	Easy
T8	Transportation	5	Semi-Public	Easy
14	Common Area	6	Semi-Private	Average
15	Common Area	6	Semi-Private	Average
A3	Music Facilities	6	Semi-Private	Average
A4	Common Area	7	Semi- Private	Average

Based on the overall permeability graph and the Likert scale table (Table 3), the level of permeability ranges from public to extremely private.

The wayfinding of the spaces varies from easy to difficult. The spaces located on the ground floor are public galleries café and restaurants (6, 12, A1) that are accessible by the public without purchasing the tickets. The main performance halls and exhibition areas are located on the first floor. There is a need to purchase the ticker before u enter. Meanwhile, the administration (C1, C4, C5) and the services (S1-S5) are categorized as private areas where they are non-accessible by the public.

4.3 Analysis of Space Syntax on First Floor Plan

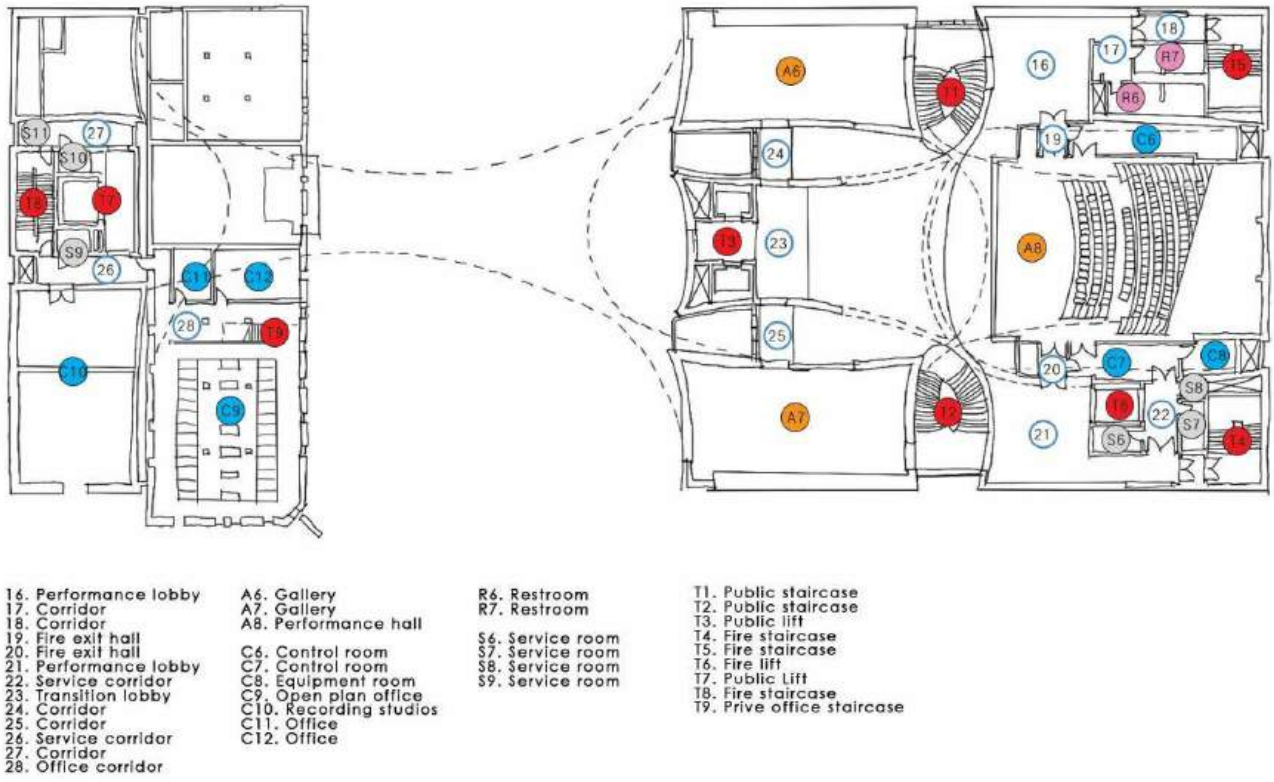

Figure 6: First Floor Plan with Legend

The helical staircases and the public lift bring visitors up to the first floor for the main performance hall(A8) and exhibition spaces (A6, A7). The visitors use both staircases on the North and South to enter the performance waiting for the lobby (16) before entering the main hall (A8). The amenities (R6, R7) and the services (S6-S9) are located at a higher level of depth. The control room (C6, C7) are located surrounding the performance hall. Meanwhile, the first floor of the second tower is the private area as the entire floor is occupied with open-plan offices (C9, C10), there are closed offices and storage (C11, C12) located near the open-plan office. Meanwhile, the services room is connected to the office through the corridor (26, 27). A similar layout repeats on the subsequent floors. For the main tower, the overall justified graph and Likert scale table show that the permeability level for the first floor ranges from semi-public to extremely private with the wayfinding level ranging from easy to very difficult. This shows that the main performance hall and

galleries (A6, A7, A8) go deeper when the floor level goes higher. Services (S6, S7, S8) and administration (C6, C7, C8) are found to be harder in wayfinding as the spaces are categorized as private areas.

As for the second tower, the spaces are accessible by vertical transportation (T7, T8). Administration areas (C9, C10, C11, C12) are dominant on this floor, which is not easily accessible by the public. Hence, the table shows that the spaces have a very high permeability level with very difficult wayfinding. From the office, there is a staircase (T9) that is only accessible by the staff to the upper floors.

Table 4: Likert Scale on Space Analysis for First Floor Plan

Area (First tower)	Category	Depth Level	Level of Permeability	Level of Wayfinding
T1	Transportation	5	Semi-Public	Easy
T2	Transportation	5	Semi-Public	Easy
T3	Transportation	5	Semi-Public	Easy
A6	Music Facilities	6	Semi- Private	Average
A7	Music Facilities	6	Semi- Private	Average
16	Common Area	6	Semi- Private	Average
21	Common Area	6	Semi- Private	Average
23	Common Area	6	Semi- Private	Average
24	Common Area	7	Semi- Private	Average
25	Common Area	7	Semi- Private	Average
17	Common Area	7	Semi- Private	Average
19	Common Area	7	Semi- Private	Average
20	Common Area	7	Semi- Private	Average
22	Common Area	7	Semi- Private	Average
T4	Transportation	7	Semi- Private	Average
T5	Transportation	7	Semi- Private	Average
R6, R7	Amenities	8	Semi- Private	Average
18	Common Area	8	Semi- Private	Average
A8	Music Facilities	8	Semi- Private	Average
S6, S7, S8	Services Area	8	Semi- Private	Average
C6	Administration	9	Private	Difficult
C7	Administration	9	Private	Difficult
C8	Administration	10	Private	Difficult
Area (Second tower)	Category	Depth Level	Level of Permeability	Level of Wayfinding
T7	Transportation	5	Semi-Public	Easy
T8	Transportation	5	Semi-Public	Easy
26	Common Area	6	Semi- Private	Average
27	Common Area	6	Semi- Private	Average
C10	Administration	7	Semi- Private	Average
28	Common Area	7	Semi- Private	Average
S9, S10, S11	Services Area	7	Semi- Private	Average
C9	Administration	8	Semi- Private	Average
C11	Administration	8	Semi- Private	Average
C12	Administration	8	Semi- Private	Average
T9	Transportation	9	Private	Difficult

4.4 Analysis of Space Syntax on Top Floor Plan

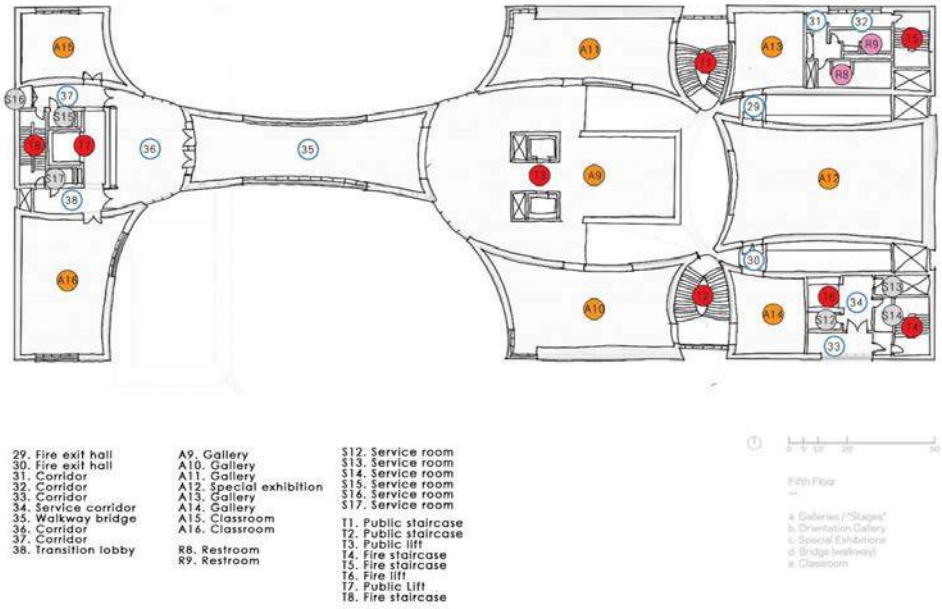

Figure 7: Top Floor Plan with Legend

On the top floor, the two towers are connected by a link bridge (35). It makes up the connection between two parts of the building, allowing a seamless flow of visitors between the two towers. The vertical transport for the public (T1, T2, T3, T7, T8) brings the visitors up to the top floor, reaching the lift lobbies respectively (A9, 36). The galleries (A10, A11) and special exhibition space (A12) are directly accessible from the lift lobby at the main tower while the classrooms (A15, A16) are accessible from the lift lobby at the second tower. Similar to the lower floors, the services (S12-S17) and amenities (R8, R9) is located at a higher level of permeability.

Both graph and table show shows that the top floor is found to be very difficult in the wayfinding. The higher the floor level, the higher the permeability level. The top floor is extremely private and consists of a classroom for music education (A10, A11) and special galleries and exhibitions (A12, A15, A16). The special exhibition areas are located attached to the services corridors and also the bridge linking the second tower. Hence, the exhibition areas can be easily accessible between the spaces on the same floor even though the spaces are considered extremely private zone.

Table 5: Likert Scale on Space Analysis for Top Floor Plan

Area (Both tower)	Category	Depth Level	Level of Permeability	Level of Wayfinding
T1	Transportation	7	Semi- Private	Average
T2	Transportation	7	Semi- Private	Average
T3	Transportation	7	Semi- Private	Average
A9	Music Facilities	8	Semi- Private	Average
35	Common Area	8	Semi- Private	Average
A13	Music Facilities	8	Semi- Private	Average
A14	Music Facilities	8	Semi- Private	Average
T7	Transportation	8	Semi- Private	Average
T8	Transportation	8	Semi- Private	Average
A10	Music Facilities	9	Private	Difficult
A11	Music Facilities	9	Private	Difficult
36	Common Area	9	Private	Difficult
29	Common Area	9	Private	Difficult
31	Common Area	9	Private	Difficult
30	Common Area	9	Private	Difficult
33	Common Area	9	Private	Difficult
T4	Transportation	9	Private	Difficult
38	Common Area	10	Private	Difficult
37	Common Area	10	Private	Difficult
A12	Music Facilities	10	Private	Difficult
32	Common Area	10	Private	Difficult
R8	Amenities	10	Private	Difficult
R9	Amenities	10	Private	Difficult
34	Common Area	10	Private	Difficult
T5	Transportation	10	Private	Difficult
T6	Transportation	10	Private	Difficult
S12, S13, S14, S15, S16, S17	Services Area	11	Extremely Private	Very Difficult
A15	Music Facilities	12	Extremely Private	Very Difficult
A16	Music Facilities	12	Extremely Private	Very Difficult

5 Discussion

The music center has shown a branching tree-formed graph in its overall circulation. The graph shows that the center is designed as multiple ways route exhibition and performance spaces. Multiple spaces branch out from each node. The multiway route is not as clear and straightforward as the one-way route. It gives multiple choices for the visitors to choose where they wish to go. A signage board to direct the users reaching the desired destination is much needed to be proposed at every node to ease the movement of the visitors. Hence, the characteristic shown by the multiple-way routes is considered complicated for first-time visitors to follow. From the justified graph, as the exhibition goes inward, the permeability of the spaces is covered from public to extremely private zones. However, there is an advantage gained from the route as the visitors have a choice to get a shortcut way to get themselves entering the desired space within the building.

Meanwhile, the service route exhibited a shallow tree-formed graph as most of the service areas are accessible through the same corridor. The services areas are located in similar spaces on every floor. However, the service spaces have a higher depth of permeability to avoid direct access from visitors. Table 6 shows that semi-private spaces occupy 51.9% of the building and have average wayfinding. The semi-private spaces are the spaces that require tickets to enter.

Table 6: Number & percentage of Spaces Based on Level of Permeability and Wayfinding

Level of Permeability and Wayfinding	Level	Spaces	Number	Percentage (%)
Public/Very Easy (0-4)	Site Plan	0,1,2	3	
	Ground Floor Plan	E1, E2, E3, E4, E5, 3, 4, 10, 5, 11	10	
			13	12.3
Semi-Public/Easy (5)	Ground Floor Plan	A1, A2, A5, 6, 7, 8, 13,	7	
	First Floor Plan	T1, T2, T3, T7, T8	5	
			12	11.3
Semi-Private/Average (6-8)	Ground Floor Plan	14, 15, A3, 12, C2, 9, R1, R2, R3, R4, R5, A4, C3, S1, S2, S3, S4, S5, C1, C4, C5	21	
	First Floor Plan	26, 27, A6, A7, A6, 21, 23, T4, T6, C10, S9, S10, S11, 28, 24, 25, 17, 19, 20, 22, C11, C12, C9, R6, R7, 18, A8, S6, S7, S8	30	
	Top Floor Plan	A9, 35, A13, A14	4	
			55	51.9
Private/ Difficult (9-10)	First Floor Plan	T9, C6, C7 C8	4	
	Top Floor Plan	A10, A11, 36, 29, 31, 30, 33, 38, 37, A12, 32, R8, R9, 34	14	
			18	17.0
Extremely Private/ Very Difficult (11-12)	Top Floor Plan	S12, S13, S14, S15, S16, S17, A15, A16	8	
			8	7.5
			106	100

Most of these spaces such as performance halls, galleries, and special exhibition areas are located on the upper floors. The public spaces which occupy 12.3% of the building are mainly located on the ground floor which is very easy to be accessed by visitors. The spaces include the entrances, information counter, café, and restaurants. Several corridors are easily accessible for the public to access the restrooms. The secondary level of permeability is shown by the semi-public spaces, the percentage shown is 11.3%. The private spaces that cover around 17% of the building are mostly made up of the administration areas such as offices and recording studios. The offices and studios are avoided to be accessed by the public to avoid unnecessary interruptions. Lastly, the least percentage, 7 5% of the overall building spaces are the special exhibition areas and classrooms for music education. The extremely private spaces are located on the top floor and have very difficult wayfinding.

Based on the results shown in Table 7, the services and amenities area have more small individual rooms compared to the music facilities as each music facility has a larger open area that opens multiple ways to the other connected exhibition areas. Hence, around 35.8% of the building which is made up of services rooms and facilities has a single connecting space. The double-connecting spaces and triple-connecting spaces have a percentage of 20.8% and 13.2 % respectively. These spaces are mostly comprised of music exhibitions and performing halls which possess the characteristic of the multiple-way route for paid visitors. 14.2% are multiple connecting spaces which are mainly made up of common areas. These spaces branch out and link most of the multi-connecting spaces together. There are approximately 7.5% of the entire building space is the

end room. The end room is mainly made up of the fire staircase and the services rooms. Lastly, 8.5% of the building consists of the staircase and lift which act as vertical transport for the building.

Table 7: Number & percentage of Spaces Based on Connecting Spaces

Connecting Space	Spaces	Number	Percentage (%)
End Room	14, 15, R1, S11, C8, A15, A16, S16	8	7.5
Single	A3, E4, E5, E1, E2, A1, R4, R5, R3, R2, E3, S4, S3, S1, S3, S2, S9, C10, C11, C12, S10, 23, R6, R7, 17, S8, S7, S6, S17, S15, S17, 32, R8, R9, S1, S13, S14, S12	38	35.8
Double	10, 11, A4, 3, 4, 6, 7, C2, S3, C4, 27, 26, A6, 24, A7, 18, C6, 22, 35, A11, 29, 30, A10	22	20.8
Triple	A5, A2, 12. C1, C3, 23, 19, 20, 36, A13, 31, A14, 33, A12	14	13.2
Multiple	13, 5, 8, 9, C9, 28, 29, 16, A8, C7, 21, 38, 37, A9, 34	15	14.2
Staircases & Lift lobbies	T1, T2, T3, T4, T5, T6, T7, T8, T9	9	8.5
		106	100

6 Conclusion

National Music center of Canada – Studio Bell is designed with a multiple-way route for the paid visitors to experience the internal spaces of the building. The design creates multiple choices for the visitors to choose from. Following the routes provided, both services and administration areas are located at a higher depth of permeability. The design is considered satisfactory as the public spaces and services are zoned. However, the design can be enhanced by appropriately allocating the directional signage to the users to have a clear vision of where they are heading. From the overall justified graph, the overall space syntax performance in Studio Bell is mostly semi-private and a have average wayfinding, it takes up approximately 51.9% of the entire building space. The semi-private spaces include a series of exhibitions, galleries, and performance halls which require entrance fees. Besides, the office is also included in a semi-private space and is not easily accessible by the public to give privacy to the personnel, protecting the space from unnecessary interruptions. In terms of space connection, the music facilities and exhibitions are mostly double and triple-connecting spaces where the series of exhibitions is connected. Meanwhile, the administration and service are mainly single connecting spaces and end rooms.

The study emphasizes the spatial relationship within the entire building based on the space syntax analysis. Studio bell has a satisfactory circulation which is designed for both public and private personnel. From the justified graph shown, the building is unique as it is separated into two towers with a busy street in between. The building is visually accessible by road users. Studio Bell has 4 entrances that enable visitors to direct access to the space based on their visiting purposes.

Due to the Covid-19 pandemic, the research is carried out online due to the movement control order implemented by the government. Perhaps a site visit can be conducted in the future to have a depth study.

7 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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