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Research Paper

A space syntax study on the Cornell University, College of Veterinary Medicine

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ABSTRACT

The design of educational building has become increasingly important concurrently due to the needs interactive and engaging spaces for improved students' academic performance. Conventional design of educational spaces invariably lack design aspects that facilitate engagement. Therefore, it has become the aim of this research to evaluate the spatial configuration a veterinary institute, based on the space syntax analysis from the spectrum of the level of wayfinding and permeability. The case study of this research is Cornell University College of Veterinary Medicine an institutional building that is a globally renowned in the veterinary industry. Being at the forefront of research into animal well-being and the prevention of infectious diseases, the building's design emphasises providing cutting-edge educational spaces and fostering innovative curricula for educating future practitioners and researchers while also extending vital support to communities worldwide. The study uses the justified graph and visual graph analysis (VGA) based on DepthMapX software to identify the level of permeability and wayfinding of the designed spaces. The analysis demonstrates that a majority of the areas covered in the case study building have moderate integration levels and between high and moderate connectivity levels. Highly integrated and connected spaces are important in spatial design of educational institutions in providing allowing for cross-disciplinary collaboration and outstanding students' engagement. In essence, the outcome of the study demonstrates the selected building typology case study building has a well-designed spatial configuration that emphasises the building's main users.

1. Introduction

Educational spaces becomes effective and meaningful when there is high connectivity allowing for social interaction for cross-disciplinary discussion (Sarıberberoğlu and Ünlü, 2024). The present study analysis the quality of spatial configuration with specific emphasis on institutional building typology. The building was designed and built to serve as a veterinary educational facility aimed at training aspiring practitioners and researchers. The justified graph is one of Space Syntax's concepts. It was the first operational analytical technique created [1]. Visibility Graph Analysis is a formula used to investigate the interior space connection of the building [2]. This approach is derived from space syntax, a set of techniques used to analyse the spatial configurations and patterns of human activity within buildings and urban environments [3]. Wayfinding is the action of making a move from one place to another place. The wayfinding will be affected by the various environmental setups as well as the level of familiarity. According to [4], permeability is when a person moves across a space network, which also indicates the relationships between the spaces. By comparing the spaces based on the permeability levels, the depth of the spaces can be evaluated [5].The case study, Cornell University College of Veterinary Medicine, located in the United States, is an institutional building that specializes on veterinary medicine.The design of the campus is a good precedent in adaptive reuse of existing campus to incorporate new state-of-the-art learning spaces. The project original intention is to adapt to the existing complex, which is currently a disparate and outdated individual building, into a cohesive and unified environment. Through a new expansion and reconfiguration, the project introduces a space arrangement that emphasises the connection of the students and staff to the additional learning and teaching spaces. Moreover, it establishes connections between the hospital and academic facilities and develops public spaces conducive to both planned and impromptu activities. The project has won a few awards; one of them is the design merit award: Adaptive Reuse/Historic Preservation. By analysing the case study's spatial organisation, the research aims to ascertain the veterinary institute's level of permeability and wayfinding. Since the building layout planning affects how users perceive spaces, the study also attempts to investigate the effectiveness of user accessibility across the building by employing space syntax [6].

2. Literature review

2.1 Space syntax: Justified graph analysis

According to Hillier and Hanson (1984), a collection of techniques called ßpace syntaxäre intended for the examination of spatial configurations and patterns of human activity within structures and urban areas [7]. Based on how users perceive the spaces they utilise, space syntax creates recognisable mapping within the architecture [8]. Space syntax involves comprehending and accessing the spatial arrangements ingrained in a social way of life [9].

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It has been proved that the arrangement of the space influences the user's impression of space, based on research by [10, 11]. According to [12], space syntax creates useful methods for obtaining data and interpreting it to reveal the social logic underlying the arrangement. Based on Rahaman et al. (2019), it can be used to a certain building's or city's spatial organization as a method for predicting socio-spatial knowledge [13]. A mathematics presentation can be used to illustrate space syntax; for example, the justified graph is used to show the building space planning in an easier understanding way [14]. Space syntax analysis is based on three basic concepts: isovist space, axial space, and convex space (Ahmad Fuad et al., 2023) [15]. Table 1 shows the difference between asymmetric and symmetric spatial systems.

Table 1. Justified graph of Asymmetrical and Symmetrical spatial system.

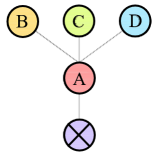
	Asymmetric Spatial System	**Symmetric Spatial System**
Example of justified graph		
Connection to root	Indirectly	Directly
Depth level	Maximum	Minimum
Integration level	Lower	Higher
Privacy	Higher	Lower

Table 2. Likert scale that measures the permeability and wayfinding.

Color	**Depth level**	**Permeability level**	**Wayfinding level**	**Accessibility level**
	6	Private	Very poor	Very hard
	6	Private	Very poor	Very hard
	5	Private	Poor	Hard
	5	Private	Poor	Hard
	4	Semi-private	Moderate	Moderate
	4	Semi-private	Moderate	Moderate
	3	Semi-private	Moderate	Moderate
	3	Semi-private	Moderate	Moderate
	2	Semi-public	Good	Easy
	2	Semi-public	Good	Easy
	1	Public	Very good	Very easy
	1	Public	Very good	Very easy
	0	Public	Very good	Very easy

2.2 Selected case study

The present study has selected the Cornell University College of Veterinary Medicine as a case study. The original design of the campus comprises of a cluster of buildings that hindered connectivity between various campus facilities and concealed the courtyard. The campus is then re-designed so that the disconnected collection of buildings is connected as a unified campus that incorporates innovative teaching and research spaces through adaptive reuse initiatives of the College. The building is considered ideal for investigation of spatial analysis because of uniquely designed facilities for educational purposes incorporating state of the art redesigned entry plaza, the gallery, double story tiered lecture halls to provide cross disciplinary and collaborative teaching and learning spaces. Additionally, the architecture is internationally recognize featuring veterinary education, research, diagnostics, animal care, and biomedical science. The building is located in Ithaca, United States where the construction of the buildingstarted in 2019 as an extension and restoration by the Weiss/Manfredi architectural team. Included in the 117,000 square foot project is a 50,000 square foot gut restoration in addition to a new 67,000-square-foot expansion. Reconnecting the hospital and college through the addition of new teaching spaces to the old complex was made possible by the selective removal of underutilised and nonadaptable structures. The concept establishes a public platform for events from the area previous complex (Archdaily, 2019) [16]. The case study building typology is categorised as institutional building. The institutional building highlights the veterinary-related educational and research needs combined with space requirements to improve the learning environments. The building's gallery and teaching and learning areas are designed for the public, whereas the research laboratory and services area are private spaces. The research case study is in Ithaca, New York.

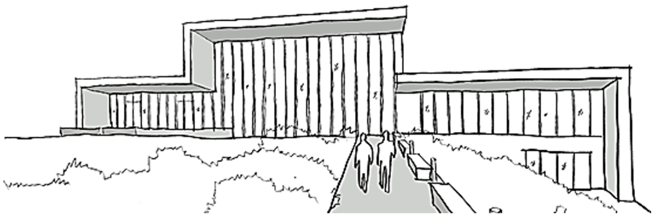


Figure 1. Exterior perspective of Cornell University College of Veterinary Medicine, (redrawn from source: archdaily.com).

Ithaca city serves as the county seat of Tompkins County. Ithaca is the largest community in the Ithaca metropolitan statistical area, located on the southern bank of Cayuga Lake. Ithaca is not only carved by gorges and waterfalls, but its educational institutions have also shaped the city. In addition to Cornell University, two more colleges are situated there, which are Ithaca College and Ivy League University. The intellect transforms Ithaca into a vibrant, global, interconnected metropolis and elevates the stunning campuses on East Hill and South Hill to the status of major global travel hubs [17]. The building is in a minimalist architectural style. The building features a big window glass façade and a geometric shape design with clean lines, as referred to in Fig. 1. Cornell University College of Veterinary Medicine's minimalist architecture places a high value on transparency, intentional design, and openness, creating a calm yet strikingly beautiful atmosphere.

3. Research methodology

The research is conducted using qualitative research methods to determine the case study background by collecting information through online research, articles, and journals. To create a justified graph that shows the permeability level and wayfinding level, the building space is labelled using the labelling and numbering indication system as proposed by Abdul Nasir et al. [18]. The case study's floor plan is traced to undergo the visual graph analysis using depthMapX software. The analysis is conducted to evaluate the connectivity and integration level of the case study. The findings from the justified graph are compared with the visual graph analysis.

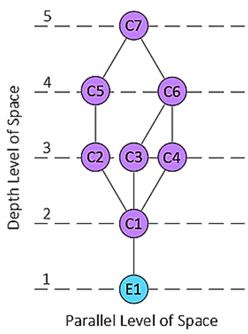


Figure 2. A representation of justified graph.

Based on Joshi et al. [19], one of the most fundamental and often used research instruments is the Likert scale. Generally, the Likert Scale includes possible answers, such as strongly agree or strongly disagree. In this research, the Likert Scale is used to measure permeability and wayfinding analysis [20]. The higher the depth level on the y-axis shown in the justified graph, the higher the privacy level of the space.

Figure 1 shows the example of a justified graph, whereas Table 2 demonstrates how the Likert Scale is used to assess wayfinding and permeability. To make wayfinding and permeability analysis easier, the building case study's spaces are labelled using a numbering system [18, 21]. Numerical numbers denote the principal functional spaces like 1, 2, 3, etc. An alphabetical numbering system, such as E1, E2, E3, etc, identifies the entrance. The corridor is denoted by C1, C2, C3, etc, whereas the stairways and lifts are denoted by S1, S2, etc., and L1, L2, etc., respectively. In addition , colour labelling is implemented to classify the primary functional spaces into public and private spaces based on the types of users, which are purple and red colour, respectively [21].

Table 3. Alphabetical numbering and colour labelling for spaces.

Spaces	Code	Alphabetical Numbering	Colour
Entrance	E	e.i. there are 3 entrance = E1, E2 and E3 by hierarchical	
Students (Public space)	–	e.i. there are 3 spaces = 1, 2 and 3 by hierarchical	
Staffs (Private space)	P	e.i. there are 3 spaces = P1, P2 and P3 by hierarchical	
Corridor	C	e.i. there are 3 corridors = C1, C2 and C3 by hierarchical	
Vertical Access (Lifts)	L	e.i. there are 3 lifts = L1, L2 and L3 by hierarchical	
Vertical Access (Stairways)	S	e.i. there are 3 stairways = S1, S2 and S3 by hierarchical	

Table 4. Level of permeability.

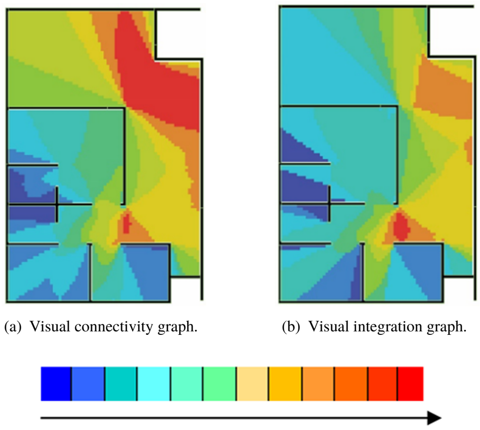
Hierarchical order	Level of permeability	VGA integration	Corresponding justified graph depth level
Primary Level	Public	High	0,1
Secondary Level	Semi-public	Moderate	2
Tertiary Level	Semi-private	Moderate	3,4
Quaternary Level	Private	Low	5,6

Table 5. Level of wayfinding.

Hierarchical order	Level of wayfinding	VGA connectivity	Corresponding justified graph depth level
Primary Level	Very Straightforward	Very High	0,1
Secondary Level	Straightforward	High	2
Tertiary Level	Moderate	Moderate	3,4
Quaternary Level	Difficult	Low	5
Quinary	Very Difficult	Very Low	6

The entrance is labelled blue, whereas the corridor and vertical access (stairways and lifts) are indicated in yellow and green, respectively. The numbering system and colour labelling of the spaces are tabulated in Table 3. The wayfinding and permeability analysis research is then aided by the labelling of the plans being converted into the justified graph. These findings show the spatial arrangements and purposes of the building [9, 22]. The example of justified graphs and measurement scales of depth levels of permeability and wayfinding are shown in Fig. 2 and Table 2, respectively.

Figure 3 shows the example of the VGA connectivity and integration graph and the colour scale of the visibility graph. DepthMapX is used to generate visibility and integration [9, 23]. DepthMapX is a software tool that is used to perform a spatial network analysis. The software intends to understand the social dynamics in the built environment [9]. In this research, visibility graph analysis (VGA) is created using the depthMapX. The outcome of the VGA is a visual connectivity graph and visual integration graph [23]. The colour scale in Fig. 2 shows the measurement of the level of integration and connectivity. The most visually integrated space is the most public space, which is represented in red colour. The least visually integrated space is the most private space, in which blue colour is used to represent it [9]. For the level of connectivity, the easiest-to-access space has the highest connectivity with a red colour representation [23]. The spaces that are difficult to access have low connectivity [24], which is represented in blue colour. According to Khozaei et al. (2022), The capacity for movement and pattern recognition inside a building's spaces is referred to as permeability. In contrast, based on Lynch (1960), the process of figuring out and travelling a path between an initial and final location is known as wayfinding [25–28]. The justified graph is used to determine the wayfinding and permeability levels. The justified graph depth level is categorised into a few categories, which are shown in the example in Table 4 and Table 5. The hierarchical order, level of permeability or wayfinding, and VGA integration or connectivity are categorised as shown in Table 4. The quantity of spaces in the corresponding justified graph depth level is then analysed and recorded in the Table 5. The following formula calculates the overall percentage.



(a) Visual connectivity graph. (b) Visual integration graph.

Figure 3. Example of (a) visual connectivity and (b) visual integration graph and color scale of visibility graph. Where the red is high connectivity and high integration, and the blue is low connectivity and low integration.

4. Results analysis

There are two user categories in this case study. The two primary users of the building are students and staff. Students are represented by purple, which indicates public space. Staff such as lecturers, researchers, and management staff are labelled in red, indicating higher privacy.

4.1 Overall justified graph

According to the justified graph of the Cornell University College of Veterinary Medicine shown in Fig. 5, there are a total of 6 depth levels. For the site plan, there is a depth level, which is from level 0 to level 1. Level 0 includes all the entrances, whereas level 1 of the site plan included an entry plaza (26) and a poisonous plant garden (27). Overall, depth levels 0 to 1 are considered public space, depth level 2 is semi-public space, depth levels 3 to 4 is semi-private space, and depth level 5 is private space. In contrast, depth level 6 is an extremely private space, as referred to in Fig. 5.

4.2 Ground floor plan

Since the entry plaza and poisonous plant garden have a depth level of 1, the space is considered a public area. Entrance E1 is for visitors or students. Even though E1 has the same depth level as other entrances (E2-E7), it is more public compared with the other entrances. Entrances E2 to E7 are for staff access, and the location is more hidden compared with E1. Based on the justified graph, access to all spaces in the site plan is very easy and straightforward as it has good wayfinding. Visitors experience ease of movement without the necessity to navigate through other areas before reaching their desired destinations. Other than that, the visitors can enter the building from entrance E1 easily from the entry plaza. There are a total of 4 depth levels for the ground floor of the case study based on Fig. 5.

Figure 7 shows that the public and private space is considered well-organized since most of the red, orange, and yellow colour indicated space is labelled with purple circles (public access) as referred to in the integration graph. The depth levels 1 to 2 are mostly public spaces, whereas depth level 3 shows a semi-private space. All the entrances except entrance 1 (E1) have low integration, shown in Fig. 7, showing that it is more private since the entrance is for staff and services purposes. The public space on the ground floor mostly consists of teaching spaces and facilities such as lower gallery (1), lecture halls (2,3,4,5), library (15), conference rooms (6,7) and classrooms (8,9). Each of these spaces is well-planned for public access and is situated at a depth of two. Although the main vertical access (S1, S3-S5, L1-L4) has a depth level of 2, only the staircase (S5) is public compared to others, according to the integration graph. S5 was indicated in yellow, while others are in cyan and blue, which have a low integration. Based on the connectivity graph in Fig. 7, the lower gallery (1) and corridor 3 have the highest connectivity and

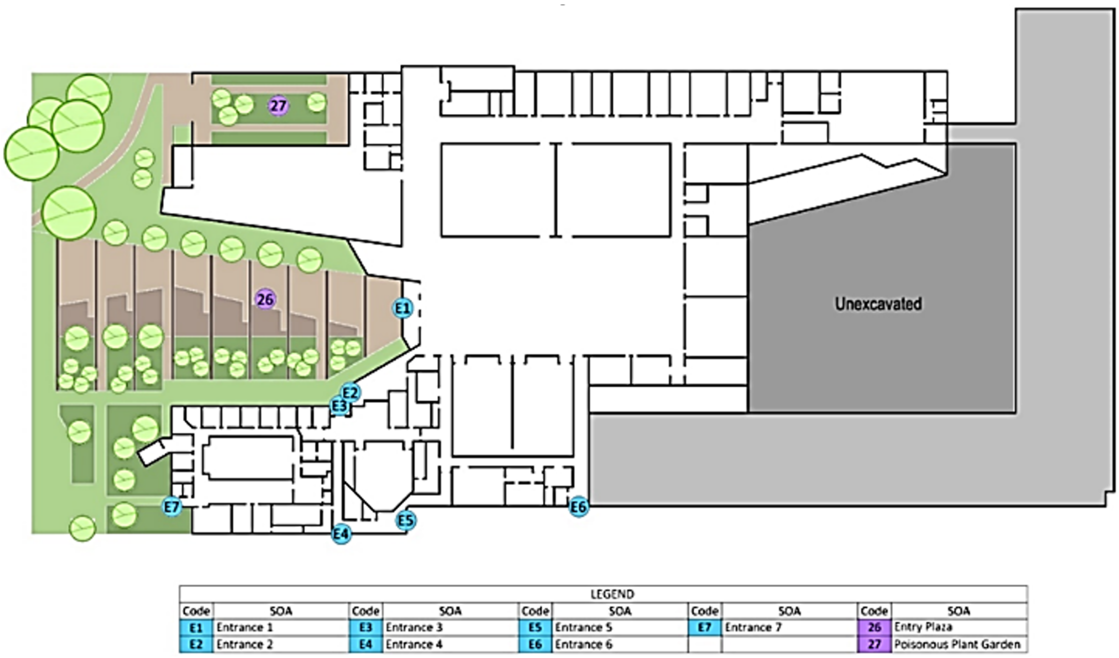


Figure 4. Site plan with SOA (redrawn from source: archdaily.com).

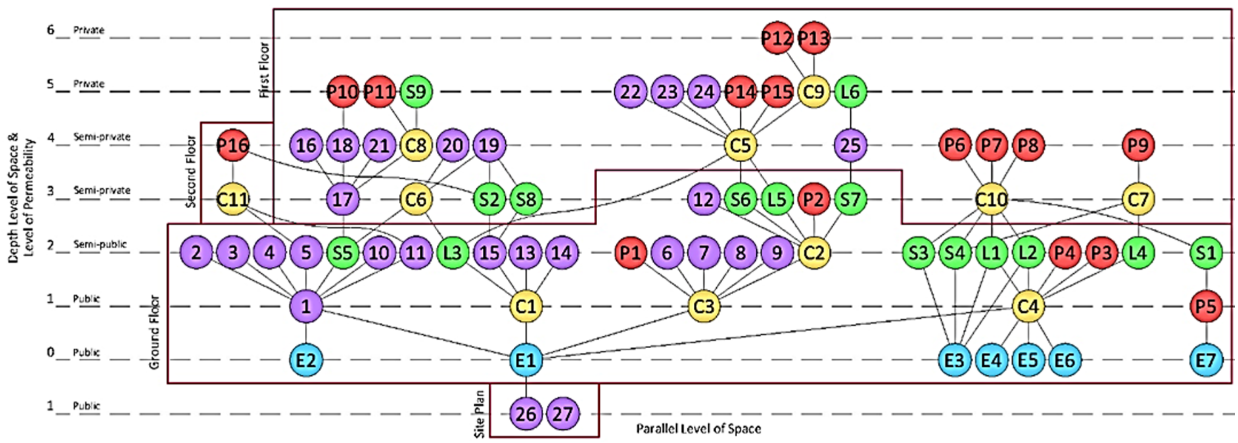


Figure 5. Overall justified graph of the building.

wayfinding level, which means the spaces are very easy to access for visitors. Private spaces such as office suites (P2), services (P3), and research labs (P4, P5) are indicated in blue colour in the connectivity graph, Fig. 7, showing that the spaces are very difficult to access. The entrances to these spaces are mostly difficult to access (E5, E6, E7).

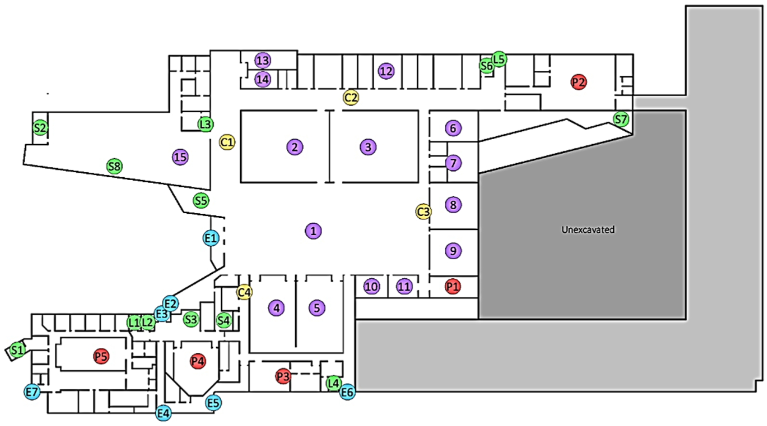
4.3 First floor

The justified graph illustrates that the overall depth level for the first floor of the case study building is 4, ranging from level 3 to level 6. Stairway 5 (S5) is the main vertical public access to the upper floor, with a light green colour indicated in the integration graph. The public spaces in the first-floor area have a depth level of 3 and 4, which are mainly the facilities such as the dining room (18), gallery (17), library (19) and teaching spaces (20,21). These spaces are indicated in orange, yellow and light green colours in the integration graph, Fig. 9, showing that the spaces have a high integration and are public. Corridors C5 and C6 are public access to public spaces such as the library (19) and tutorial room (22). The server (P10), research lab 4 (P11), locker rooms 1and 2 (P14, P15), tutorial room (P22), and toilet 3 (P23, P24) have a depth level of 5, which are categorised as semi-private spaces. Corridors C7,8,9,10 access semi-private and private spaces that are labelled in a red colour circle, with a cyan and blue colour indication in the integration graph, Fig. 9. According to the connectivity graph in Fig. 9, the upper gallery (17), dining room (18) and courtyard (25) have easy wayfinding, which shows that these spaces are very easy to access. The staircase (S5) is the primary vertical access to these public spaces. Based on the justified graph, research labs (P12, P13) are the most difficult to access space, with the highest depth level of 6, which are located far away from the entrance of the building. Level 3 and level 4 are the two depth levels for the second floor of the case study that are shown in the justified graph. Level 3 is corridor 11 (C11), which can be accessed from L3 and S5 to the dean's suite (P16), whereas the space at level 4 is the dean's suite. The second floor is the most private. The integration graph in Fig. 9 indicates all the spaces in blue colour, showing a low integration level. In addition, the space on this floor is the dean's suite, which is considered a private space. According to the connectivity graph in Figure 9, the spaces with the highest connectivity level are Corridor 11 (C11) and the lobby of the dean's suite. The small rooms inside the dean's suite are indicated in blue colour, which is very difficult to access. The users can access the second floor by staircase and lift (S2, S5, L3). All these vertical accesses show a low connectivity level in the connectivity graph, Fig. 9.

5. Discussion

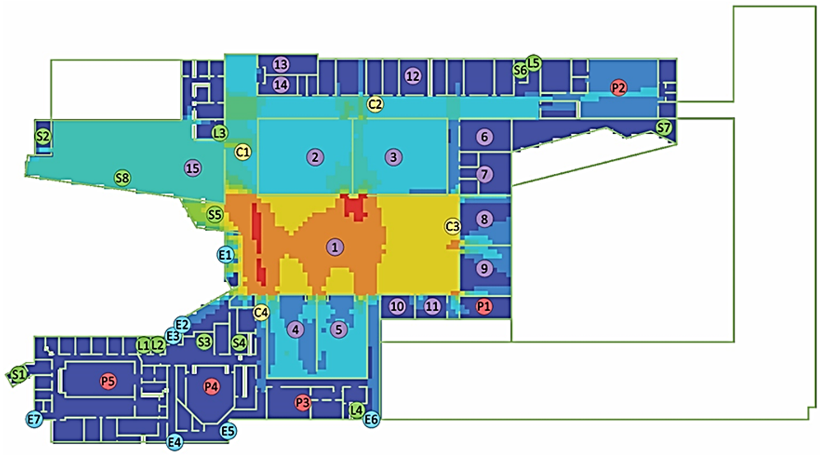
The general form of the justified graph is an asymmetrical structure, as shown by the justified graph in Fig. 5. The asymmetrical nature is characterized by having all the entrances (E1 to E7), lobby (1), and corridors (C1, C3, C4) adjacent to the root of the building's spaces, providing optimum guide to the users' wayfinding towards the inner part of the building.

The overall structure provides better security management and public circu-



LEGEND									
Code	SOA	Code	SOA	Code	SOA	Code	SOA	Code	SOA
E1	Entrance 1	P3	Services	3	Lecture Hall 2	12	Tutorial Room	S6	Staircase 6
E2	Entrance 2	P4	Research Lab 1	4	Lecture Hall 3	13	Female Toilet 2	S7	Staircase 7
E3	Entrance 3	P5	Research Lab 2	5	Lecture Hall 4	14	Male Toilet 2	S8	Staircase 8
E4	Entrance 4	C1	Corridor 1	6	Conference Room 1	15	Library	L1	Lift 1
E5	Entrance 5	C2	Corridor 2	7	Conference Room 2	S1	Staircase 1	L2	Lift 2
E6	Entrance 6	C3	Corridor 3	8	Classroom 1	S2	Staircase 2	L3	Lift 3
E7	Entrance 7	C4	Corridor 4	9	Classroom 2	S3	Staircase 3	L4	Lift 4
P1	Storage	1	Lower Gallery	10	Male Toilet 1	S4	Staircase 4	L5	Lift 5
P2	Office Suite	2	Lecture Hall 1	11	Female Toilet 1	S5	Staircase 5		

Figure 6. Ground floor plan with SOA (redrawn from source: archdaily.com)

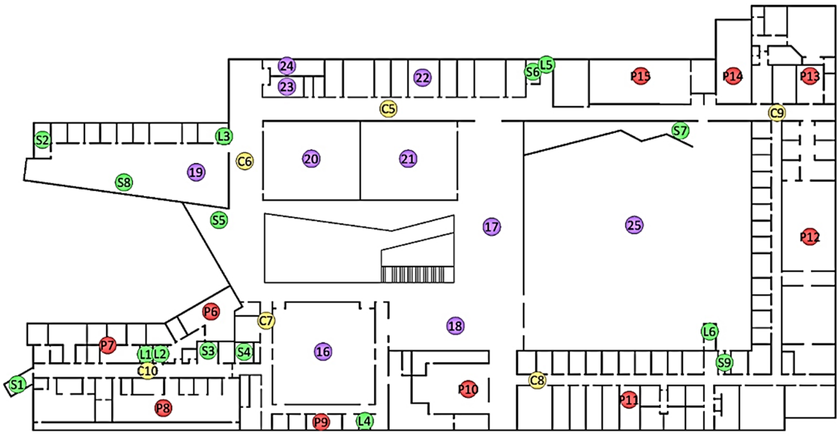


(a) Ground floor plan - visual connectivity graph.

(b) Ground floor plan - visual integration graph.

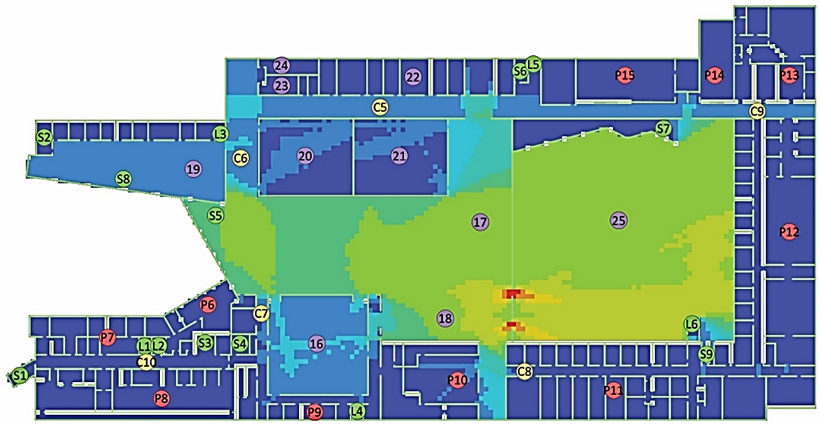
Figure 7. Visual connectivity (a) and visual integration (b) graphs of ground floor plan.

lation as the the syntactic characteristic of the building which has the higher tendency to be more public offering a clear wayfinding. The depth of space created by the spatial configuration echoes the high level of visual integration and connectivity of the campus. Accordingly, most of the spaces tend to cluster in the latter half of the higher depth levels, and accessibility is facilitated by navigating through a sequence of additional spaces. This design indicates that the building is organised in a way that promotes a semi-public nature, providing security to the occupants while simultaneously allowing some flexibility for

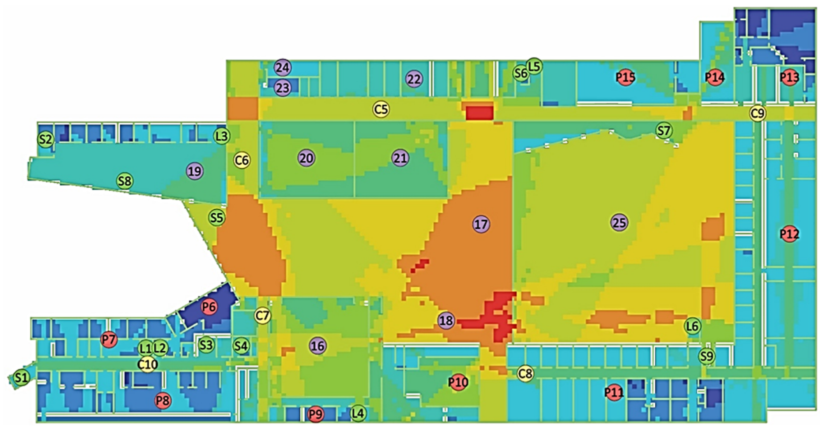


LEGEND							
Code	SOA	Code	SOA	Code	SOA	Code	SOA
P6	Research Lab 3	C5	Corridor 5	20	Lecture Hall 5	S5	Staircase 5
P7	Lecturer Room 1	C6	Corridor 6	21	Lecture Hall 6	S6	Staircase 6
P8	Lecturer Room 2	C7	Corridor 7	22	Tutorial Room	S7	Staircase 7
P9	Services	C8	Corridor 8	23	Male Toilet 3	S8	Staircase 8
P10	Servery	C9	Corridor 9	24	Female Toilet 3	S9	Staircase 9
P11	Research Lab 4	C10	Corridor 10	25	Courtyard	L1	Lift 1
P12	Research Lab 5	16	Dry Lab	S1	Staircase 1	L2	Lift 2
P13	Research Lab 6	17	Upper Gallery	S2	Staircase 2	L3	Lift 3
P14	Locker Room 1	18	Dining Room	S3	Staircase 3	L4	Lift 4
P15	Locker Room 2	19	Upper Library	S4	Staircase 4	L5	Lift 5
						L6	Lift 6

Figure 8. First floor plan with SOA (redrawn from source: archdaily.com).



(a) First floor plan - visual connectivity graph.



(b) First floor plan - visual integration graph.

Figure 9. Visual connectivity (a) and visual integration (b) graphs of first floor plan.

the general public to access within certain areas of the campus. This is evident especially theaccess through a series of interconnected supplementary spaces in the latter portions of the higher depth levels [29, 30]. This spatial design provides a welcoming gesture into the building spaces while maintaining the privacy through the carefully designed level of permeability. Apart from the evident from the justified graph, the semi-public nature of the building is also reflected the building user's activities. The building is a mixture of institutional and educational typologies, building that focuses on teaching and learning.

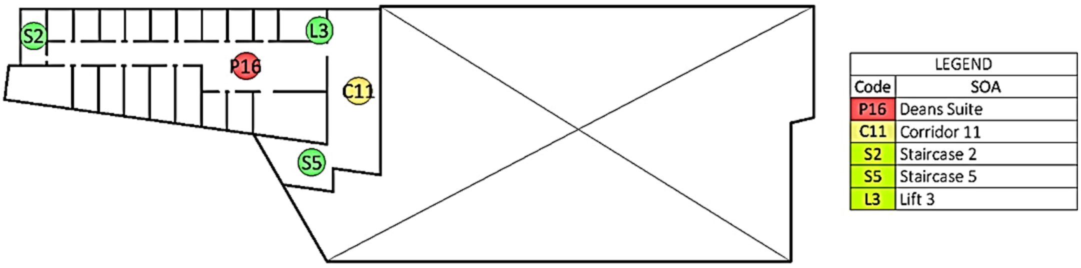
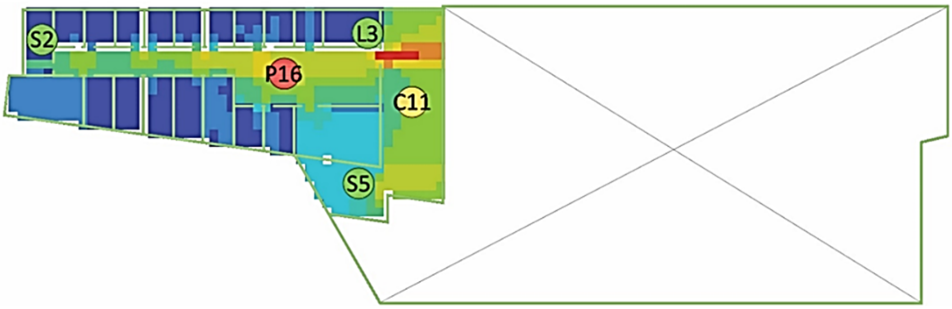
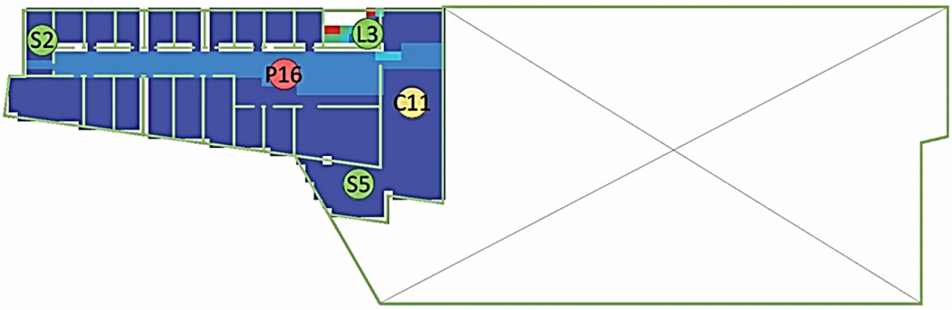


Figure 10. Second floor plan with SOA (redrawn from source: archdaily.com).



(a) Second floor plan - visual connectivity graph.



(b) Second floor plan - visual integration graph.

Figure 11. Visual connectivity (a) and visual integration (b) graphs of second floor plan.

Table 6. Level of Permeability using Hierarchical Order from high to low percentage.

Hierarchy order	Level of permeability	VGA integration	Corr. justified graph depth	No. of spaces	%
Secondary Level	Semi-public	Moderate	2	25	32.89
Tertiary Level	Semi-private	Moderate	3,4	25	32.89
Primary Level	Public	High	0,1	14	18.42
Quaternary Level	Private	Low	5,6	12	15.79

Table 7. Level of Wayfinding using Hierarchical Order from high to low percentage.

Hierarchy order	Level of wayfinding	VGA connectivity	Corr. justified graph depth	No. of spaces	%
Secondary Level	Straightforward	High	2	25	32.89
Tertiary Level	Moderate	Moderate	3,4	25	32.89
Primary Level	Very Straightforward	Very High	0,1	14	18.42
Quaternary Level	Difficult	Low	5	10	13.16
Quinary	Very Difficult	Very Low	6	2	2.63

The configuration allows straightforward and moderate wayfinding for the students and staff to access the spaces, at the same time providing controlled access for the public to provide security to the students from outsiders [31]. According to the tabulated data in Table 6, semi-public and semi-private have the highest percentage of permeability level of the overall schedule of accommodation, which is 32.89% each. The public and private spaces in the building have a percentage of 18.42% and 15.79 %, respectively. Based on the tabulated data in Table 7, the building has a straightforward and moderate wayfinding, showing the same overall percentage of 32.89%. Since the case study building is an institutional building that focuses on education, most of the space is considered straightforward and easy to access, for example, classrooms, lecture halls and so on. The private spaces such as services, dean's suites and research labs are restricted to access. The space's connectivity level decreases with increasing depth level. According to the data tabulated in Table 8, the end room has the highest percentage, which is 44.74%. This shows that almost half of the spaces had established privacy for the students and staff to undergo their daily learning and teaching activities. Double connecting space has the lowest percentage of 1.32%, which is the library that is connected to staircases S2 and

S8. Vertical access, such as staircases and lifts, is mostly distributed at depth levels 0,1 and 2, and the others are distributed evenly among depth levels 3, 4, 5 and 6, accommodating users with varying privacy needs. This distribution strategy ensures that users at different privacy levels can conveniently access vertical transportation facilities throughout the building.

Table 8. The percentage of spaces inside the building based on different depth levels.

Spaces	Justified graph depth levels			%
	0,1,2	3,4	5,6	
End room	2, 3, 4, 6, 7, 8, 9, 10, 13, 14, 27, P1, P3, P4	12, P2, P6, P7, P8, P9	16, 19, 20, 21, 22, 23, 24, P10, P11, P12, P13, P14, P15, P16	44.74
	41.18%	17.65%	41.18%	
Single connecting	5,11, 26, P5	18, 25	—	07.89
	66.67%	33.33%	00.00%	
Double connecting	15	—	—	01.32
	100.00%	00.00%	00.00%	
Multi connecting	1	17	—	02.63
	50.00%	50.00%	00.00%	
Entrance and Lobby	E1, E2, E3, E4, E5, E6, E7	—	—	09.21
	100.00%	00.00%	00.00%	
Corridor	C1, C2, C3, C4	C5, C6, C7, C8, C10, C11	C9	14.47
	36.36%	54.55%	09.10%	
Staircase	S1, S3, S4, S5	S2, S6, S7, S8	S9	11.84
	44.44%	44.44%	11.11%	
Lift	L1, L2, L3, L4	L5	L6	07.89
	66.67%	16.67%	16.67%	

6. Conclusions

The Cornell University College of Veterinary Medicine is a well designed example of adaptive reuse campus project according to the building purpose, with most of the spaces being semi-public or semi-private and mostly having straightforward access. The spatial layout is designed and organised, with each area allocated based on its designated function. Most of the spaces are end rooms, restricting access and providing privacy for daily learning and teaching activities. The research objective to determine the permeability and wayfinding level is achieved and the results are affected by the building function. Overall space syntactic performance was demonstrated by the findings, which included straightforward wayfinding and semi-public and semi-private typology for successful user accessibility throughout the building. The result is supported by the justified graph and visual graph analysis. As most of the building users are students and teaching staff, the spaces are well-designed by providing a certain level of privacy to secure the public from direct entry, according to the research result. Private teaching and learning spaces, such as research laboratories equipped with expensive equipment, have higher privacy and permeability to restrict access. In terms of wayfinding, the straightforward access guides the main building users, students and staff to the learning and teaching spaces of the building. The building provides secondary entrances (E2 to E7) that can access the building with higher privacy spaces, for example, research laboratories and services. The case study space arrangement is designed based on the primary building users and function, creating an efficient user experience from the entrances to the destination. Most spaces are easily accessible, and there is a semi-public permeability to regulate public access, contributing a positive result to the schedule of accommodation (SOA) of the building typology. The overall spaces of accommodation of the building typology give positive results without negative findings. The limitation of the study is the restricted information available in the case study building online. Extensive research can be conducted by utilising other data resources, resulting in more detailed and accurate results.

Authors' contribution

All authors contributed equally to the preparation of this article.

Declaration of competing interest

The authors declare no conflicts of interest.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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