

IMPROVING OPEN SPACES SURROUNDING PUBLIC BUILDINGS : FOCUSING ON VIGIBILITY GRAPH ANALYSIS OF CASES IN SEJONG

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ABSTRACT

In modern society public buildings are essential in order to improve citizens' quality of life and their contemporary use is considered to be an important topic in South Korea. It has been suggested that their open spaces should be overhauled and made to be easier and more convenient to use. Even though the importance of such spaces is being recognised, there is insufficient discussion of their planning direction. Three public buildings in Sejong were selected for this study given that they have undergone active planning under the new regulations of their city council. In order to derive research directions, historic and current issues related to each public building must be considered. After a review of such, the following research directions were concluded: 1) Spatial integration, 2) Spatial relation, 3) Spatial controllability and 4) Spatial decision-making. To analyse research cases, Visibility Graph Analysis (VGA) was used alongside a site survey to create improvement directions and renovation strategies. As a result of this evaluation, improvements related to spatial integration, spatial relation, spatial controllability and spatial decision-making in the open spaces surrounding the public buildings are expected to increase their usage. In turn, this should reduce negative factors such as a lack of walking space, large steps to the building entrance, high fences and walls. To create better public buildings, re-establishing planning directions and strategies for their open spaces is crucial.

Keywords: open space, public building, Sejong, Visibility Graph Analysis, Space Syntax

INTRODUCTION

1. Research background and objectives

Currently, the importance of public buildings in South Korea is under discussion. Public buildings for various purposes have been constructed, and numerous programs which benefit public citizens are underway. Public buildings should function as a facility for the general public but they are often overlooked by local communities who may not realise they exist or the role they can play. As such, the use of open spaces should be recognised and improved so that they help make public buildings more accessible. However, research into public buildings and their surroundings thus far has mainly focused on planning and operation from an administration perspective. In other words, the research should be conducted from a spatial approach in order to draw conclusions which generate an increase in the public's actual use of the spaces. Thus, this study will mainly discuss how to increase the usage of surrounding open spaces from a spatial perspective. In turn, the purpose of this study is to change the perception of a public building's open space to gain public recognition of its importance.

2. Research scope and methodologies

This study was motivated by previous research into historic and present day issues in public buildings. The study cases included in this paper were selected from a previous study conducted by Lim, Lee & Kim (2019) which evaluated the status of public buildings and their open spaces. The public building's site surveys helped set improvement directions and renovation strategies which were evaluated through Visibility Graph Analysis (VGA) completed before and after renovations. The results were discussed and evaluated from a spatial perspective and used to derive a conclusion.

Category	Research Stages	Methods
<i>Improvement Directions and Renovation Strategies</i>	<i>Research Direction</i>	<i>Literature review (Previous and current spatial issues of public buildings and their open spaces)</i>
	▼	
	<i>Case studies</i>	<i>Analysis of spatial condition</i>
	▼	
	<i>Improvement Directions and Renovation Strategies</i>	<i>Site survey</i>
	▼	
	<i>Evaluation</i>	<i>Visibility Graph Analysis (VGA)</i>
	▼	
<i>Interpretation of evaluation results</i>		<i>Discussion</i>
▼		
<i>Conclusion</i>		

Figure 1. Research scope and methodology

LITERATURE REVIEW

The literature included in this review details the factors considered when planning and constructing public buildings and their surroundings with use of spatial evaluation methods. In the past, public buildings were recognised as administrative-centred institutions but now, public buildings have become more accessible, not institutional to citizens by introducing user-focused programs including culture and welfare programs. To this end, according to Lee & Kim (2000), to spatially encourage citizens to use, an integrational plan is needed by connecting its interior and exterior with the architectural diversity. This is the one of spatial methods to draw the publicity of public buildings composing a space mainly for the citizens as a user. In addition, the structure of open spaces surrounding public buildings can create its own open spatial network. This provides a spatial experience to the citizens that allows them to naturally enter the public building without any spatial restriction. According to Hyun (2018), it is to further enhance the publicity of public building resulting in the point that citizens have a hierarchical advantage within the space. Similarly, it is also noted that the public building planning with user high occupancy can result in more interaction with people in current society. In addition, as presented by Song & Kim (2012), the building should function as an opened public place. Accordingly, it was also mentioned that the space should aim to allow equal public access by actively attracting people without being passive. According to the terms of spatial use, when people share and use a space, they would create a spatial basement of community appeared in their spatial co-presence (Hillier, 1996, 2007; 141). This indicates that more people experience the spaces and spatial consensus would be realised. In other words, improved open

space would make people more spatially co-present and the aspects of the spaces would lead further spatial recognition of the public buildings in terms of spatial integration and spatial relation. Furthermore, based on the findings (Hillier, 1996, 2007; 253), it can be said that more spatial use would create diverse patterns of spatial integration and in other words, better open space would produce better types of spatial integration with public buildings. The new way of spatial use would support the space being more productive by its increasing users. In other words, it would prevent spatial conservation by users' diverse spatial experience. The aspects of the open spaces would result in the users' diverse spatial patterns on how to use the spaces and how to access to the public buildings. It would affect the level of users' spatial dominance and it can be explained in terms of spatial controllability and spatial decision-making. In turn, to increase the usage of public buildings today, it is needed to study on the open spaces surrounding public buildings is unavoidable as a first spatial point to access to the public buildings. To look at the way of practical use, with the reference of the finding (Hillier and Hanson, 1984; 20-21) it should be discussed within the local spatial scope. Furthermore, based on the finding (Turner et al., 2001; 108-109), the analysis of spatial visibility within the stride scope would support to look at the spatial aspect. From the research issues and methods, it should be implemented to determine the spatial impact of open spaces surrounding public buildings in terms of spatial integration, spatial relation, spatial controllability and spatial decision-making from the practical viewpoint of spatial use.

ANALYSIS

1. Case studies

In order to understand the use of present day open spaces within public buildings in South Korea, research cases with high usage rates were selected from Sejong. These cases had previously been selected and analysed in a previous study (Lim, Lee & Kim, 2019). In Sejong, a new multifunctional administrative city has been built, as such, major plans for renovation are being considered. This could benefit a variety of public buildings including: educational facilities, cultural buildings, and sports facilities. Furthermore, new policies aim to improve the quality of public buildings and to establish them as landmarks of this new multifunctional administrative city. The outline of each case is shown in the table below which outlines the spatial issues of each open space including: Lack of walking space, the long-distance to the buildings from the open space and high fences and walls. (Lim, Lee & Kim, 2019; 49, 52, 55)

Category		Function	Area	Open space issues
Case1	Sejong Cultural Centre	Culture and education	1,808m ²	Lack of walking space A long-distance to the buildings from the open space High fences and walls
Case2	Jochiwon Youth Centre	Youth health	-	
Case3	BukSejong Welfare Centre + Jochiwon Complex Community Centre	Welfare	4,866m ²	

Figure 3. Research cases

Includes data from Lim, Lee & Kim (2019; 49, 52, 55)

2. Spatial conditions and Site survey

For open space issues, spatial conditions were analysed from each perspective of spatial integration, spatial relation, spatial controllability and spatial decision-making, investigating the status through the site survey. The overview of spatial analysis and site survey is as follows. (Lim, Lee & Kim, 2019; 210-215, 228-233, 234-239)

Category	Plan	Site Survey
Case 1		
Case 2		
Case 3		

Figure 4. Research case overview

Includes data from Lim, Lee & Kim (2019; 210-215, 228-233, 234-239)

Category	Spatial Analysis Overview	Site Survey Overview
Case 1	<i>Given that the space between the two buildings was initially designed for parking, pedestrians' spatial continuity is insufficient.</i>	<i>A space between buildings which lacked sufficient connection due to parking</i>
Case 2	<i>The space of the building was not sufficiently planned to connect well to its open space.</i>	<i>The building was disconnected to its open space.</i>
Case 3	<i>There was restricted public access.</i>	<i>High fences and walls surrounded the building.</i>

Figure 5. The analysis of spatial conditions and visitors behaviour/site survey

Includes data from Lim, Lee & Kim (2019; 210-215, 228-233, 234-239)

As shown by the results from the spatial analysis and site survey (fig.4), the public buildings and open spaces lacked sufficient connection given that there are no entrances to the building, except for the main entrance and the secondary entrance. The car parking space at the front of the building was also discovered to pertain to a low citizen utilisation rate. In addition, the use of a high fence in combination with a surrounding wall caused the open space and the public building to lack visibility

(Lim, Lee & Kim, 2019; 210-215, 228-233, 234-239). Lastly, there were several problems related to the access of the open spaces in terms of spatial integration, spatial relation, spatial controllability, and spatial decision-making.

3. Improvement directions and renovation strategies

Improvement directions and strategies were derived in part, thanks to research conducted by Lim, Lee & Kim (2019; 155) in addition to analysis of spatial conditions, visitors' behaviour and site survey analysis.

Category	Case 1	Case 2	Case 3
<i>Improvement direction</i>	<i>Increasing the area of walking space</i>	<i>Decreasing large steps to the building entrance</i>	<i>Increasing accessibility to the building</i>
<i>Renovation strategy</i>	<i>Transforming parking space</i>	<i>Adding a building entrance</i>	<i>Removing fences and walls which restrict access</i>

Figure 6. Improvement directions and renovation strategies

Includes findings from Lim, Lee & Kim (2019; 155)

(3) Spatial analysis (VGA)

Visibility graph analysis (VGA) is a method of analysing the inter-visibility connections within buildings or urban networks. Turner and his colleague at UCL (2001) developed the VGA under the Space Syntax theory, and it can be applied to the open spaces to analyse its spatial networks within architecture or urban area. If the colour in result becomes redder, it means the numerical value of a factor is higher.

Category	VGA factors	The Meaning of Factors
<i>Spatial integration</i>	<i>Visual Integration</i>	<i>Visual integration refers to how entire spaces are related to other specific spaces. People are more likely to enter spaces with a high integration value as they have greater levels of accessibility and spatial usage. (Turner, A. et al., 2001; 108-109)</i>
<i>Spatial connection</i>	<i>Visual Connectivity</i>	<i>Visual connectivity measures how many spaces are connected to a particular space. If more spaces are connected, it suggests the spaces have greater spatial choice and relevance. (Turner, A. et al., 2001; 108-109)</i>
<i>Spatial controllability</i>	<i>Visual Controllability</i>	<i>Visual controllability relates to the amount of space dominated by people. Spaces which are highly controllable have a higher amount of areas visible from the core, where they all connect. (Turner, 2004).</i>
<i>Spatial decision-making</i>	<i>Visual Clustering Coefficient</i>	<i>Visual clustering coefficient measures the value of people's decision-making within a space. This must consider all potential uses of the spaces and its surroundings. (O'Sullivan & Turner, 2001).</i>

Figure 7. The factors of VGA



Figure 9. The Example of Visibility Graph Analysis
Case 3. Removing inaccessible fences and walls

<i>Category</i>	<i>Case 1</i>		<i>Case 2</i>		<i>Case 3</i>	
	<i>Renovation</i>					
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
<i>Visual Integration</i>	6.34	6.78	4.83	4.86	5.53	6.00
<i>Visual Connectivity</i>	454.78	469.19	431.41	433.41	556.65	602.29
<i>Visual Controllability</i>	0.33	0.32	0.32(9)	0.32(6)	0.33	0.31
<i>Visual Clustering coefficient</i>	0.86	0.85	0.77(2)	0.77(0)	0.83	0.82

Figure 10. The result of VGA

After conducting VGA, all three research cases reached a general consensus in terms of the difference between the pre-renovation results and post-renovation results. Based on a theory presented by Hillier & Hanson (1984; 20-21) the spatial area used for VGA was limited to a local land site, this would allow the study to evaluate spatial directions from a practical perspective. The results related to visual integration were found to be relatively higher after the renovation work had been completed in all three cases. Connectivity analysis reached the conclusion that values were also relatively higher after the renovation. In terms of the controllability and clustering coefficient, prior to the renovation, both values were higher than after renovation in each research case. It should be noted that the results also referred to data obtained from a previous study (Lim, Lee & Kim, 2019; 155).

DISCUSSION AND CONCLUSION

Based on the analysis, the renovation of open spaces would improve the use of the public buildings overall. In terms of spatial integration, before the improvements, each case showed the values as presented in the analysis (VGA) being lower than the value after improvement. Therefore, people would experience the open spaces more after renovation. Based on the arguments presented by Hillier (1996, 2007; 253) It would result in users' spatial co-presence and further co-awareness from the increased spatial experience. From the perspective of spatial relation, previous to the improvement, the connectivity degrees were relatively low, and it meant that the spatial relation between open spaces and public buildings would increase although the impact before and after the improvement was relatively insignificant. Additionally, it would affect the increasing of the movement to the public building and the building would be better recognised as the users' next route through the open space (Hillier & Hanson, 1984; 103). In terms of spatial controllability, before the improvements, people could not control their spatial usage related to the higher level of the spatial conditions. However, after the improvements, people would use the open space surrounding the public buildings slightly more effectively due to less restrictions on their movements. Based on the findings of Hillier & Hanson (1984; 109), the new spatial condition of the open space would encourage visitors to follow its spatial way of use with the lower spatial control ability. In terms of spatial decision-making, before the improvements, people could not decide their spatial use as a result of the higher level of the spatial conditions. However, after the improvements, people would use the open space surrounding the public buildings slightly easier of their own volition with the lower level of clustering coefficient (O'Sullivan & Turner, 2001).

Thus, it can be said that the increasing use of the open spaces would provide a new way of spatial experience to the public buildings. More people would utilise the open spaces. More people would use spaces that have been controlled and adjusted for a more spatial experience. People would have more chances of co-presence in the spaces and further co-awareness with common but more diverse spatial experience. In other words, it means that the improvement of the open space will affect people's spatial understanding about making public buildings more welcoming and less institutional and as an everyday building, providing more public awareness. Therefore, the improvement of open space surrounding public buildings should be implemented for the efficient use of public buildings as a more open place for the citizenry. As highlighted by Lim, Lee & Kim, (2019: 115, 125), it is necessary to develop the spatial planning directions and strategies with aim of contributing to the citizens' life with more open spaces and public buildings. Moreover, it is essential to plan public buildings as an integrated space with its open spaces, not a space detached from. This research provides a basis for such a plan, and as a result, it can be said that it is vital to establish an integrated plan with the spaces around the building so that public buildings become essential spaces for the citizens.

This study was conducted from the physical perspective on the local spatial-levelled analysis to evaluate spatial impact on the pedestrian level, which is a distinctive research point from the previous policy-levelled study (Lim, Lee & Kim, 2019). For the next step it is needed to extend the research scope to the global spatial level such as district, region, and the city, which is to analyse the interrelationship between the public buildings and its city to see the global social impact into the site as covering the limitation of the study analysed on the site level from the local spatial perspective.

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