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A Basic Study on the Planning of Lower Floors According to the Enlargement of Geriatric Hospitals

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Abstract

Recently, the number of geriatric hospitals integrated with urban, social, and living aspects is increasing to solve issues related to the elderly. However, there are no clear standards to differentiate large geriatric hospitals from general hospitals. Moreover, the lack of lower-level space planning for outpatient care, central medical treatment, and public space frequently used by the elderly acts as an unsuitable factor for the elderly using large geriatric hospitals. Therefore, this study chose and verified a large geriatric hospital in Korea to build basic data. Therefore, this study used space syntax, a method for analyzing spatial hierarchies, and derived space syntax indicators related to recognition and access for spatial hierarchy analysis. The main findings are as follows. Large geriatric hospitals can enhance benefits and effectiveness by designing spatial hierarchies and cognition in consideration of the circulation hierarchy for senior citizens. However, the large geriatric hospital in this study showed low connectivity, control value, and intelligibility, which are indicators of Space Syntax. This will result in difficulties for the elderly to use the lower floors and the spaces near these areas in geriatric hospitals. Therefore, as we enter super-aging societies, geriatric hospitals should be designed by considering the spatial planning of lower floors for the elderly to improve connectivity, control value, and intelligibility. This will increase the effectiveness of large geriatric hospitals by increasing the use of space for the elderly.

Keywords: *Geriatric hospital, Low level, Intelligibility, Space syntax*

1. Introduction

Modern societies are experiencing various problems caused by the rapid growth of aging populations [1]. These problems are generally classified into four categories: housing, leisure, home care facility, and medical [2]. In particular, an increase in the number of elderly people suffering from various chronic diseases has led to increasing demands for geriatric hospitals [3]. The hospital industry is recently experiencing growth in size and subdivisions due to the increase in medical demand and the enlargement of hospitals [4]. However, geriatric hospitals experience difficulties in the design and research phase because they must reflect the special characteristics of the elderly as well as the hospital [5][6]. Also, geriatric hospitals do not reflect the various characteristics of the elderly in the spatial planning of hospitals. In this regard, research on spatial design due to the enlargement of geriatric hospitals is necessary, but in reality, there is a significant lack of studies on geriatric hospitals [7]. Therefore, the

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purpose of this study is to build basic data related to the planning and design of large geriatric hospitals by analyzing the spatial hierarchies in a geriatric hospital in Korea.

2. Geriatric hospital and analytical methodology

2.1. Consideration of geriatric hospital

Under the Welfare of Senior Citizens Act, geriatric hospitals are classified as nursing facilities, special nursing facilities, and geriatric welfare facilities. That is, geriatric hospitals are facilities that provide medical care for the elderly and are operated as a type of nursing hospital [8]. The definition of aging and the elderly includes physical, social, and psychological loss, which means dedicated spaces for the elderly should be designed to facilitate cognition and access. Spaces for the elderly should include physical and psychological characteristics as well as cognitive characteristics. The concept and facilities of geriatric hospitals differ depending on the researchers. Geriatric hospitals are generally divided into wards, outpatient care, central medical treatment, management, service, and auxiliary facilities. Due to the rapid growth of aging populations, the area ratio for these sectors differs from general hospitals. Therefore, hospital wards occupy more space, while outpatient and central medical treatment departments account for a smaller proportion. This is because older patients have a longer average length of stay compared to general patients. This study analyzes the circulation of patients, guardians, and the employees in the outpatient and central medical departments to increase the space, accessibility, and awareness of the elderly to minimize difficulties in real life. Therefore, this study is limited to the outpatient, central medical treatment, and auxiliary facilities where outpatients visit and receive medical treatment among the factors constituting large geriatric hospitals [9].

2.2. Consideration of analysis methodology

This study used space syntax as a methodology for analyzing the accessibility and awareness of the lower floors of a geriatric hospital. Space syntax quantitatively analyzes the characteristics of individual spaces in the entire space by assuming that the spatial structure in the real world is a network between spaces. The evaluation indicators and details derived from this process are as follows. Connectivity refers to the number of connections from a designated convex space to other convex spaces. A convex space with high connectivity is expected to be congested due to the high frequency of use in the spatial hierarchy. The control value is a quantified figure of the influence of a specific convex space on an adjacent convex space. If the passage to an adjacent convex space is high, the convex space has a high control value. Global integration is a numerical representation of the relationship between a specific convex space and other convex spaces in the entire space. This refers to the number of convex spaces to approach other convex spaces from a certain convex space, and a high integration means that it is easy to access other spaces. Lastly, intelligibility refers to the correlation between global integration and local integration, and the higher the correlation between the two indicators, the higher the awareness of the space [10][11].

3. Analysis method and results

3.1. Selecting the subject hospital

As this is a basic study on lower floor planning according to the enlargement of geriatric hospitals, the process of selecting the hospital for the analysis is important. Therefore, this study reflected the following to choose the appropriate hospital. First, there are no criteria for classifying the size of geriatric hospitals, so this study applied the criteria for general hospitals (100 - 300 beds). Second, a total of seven or more medical departments were selected. However, this study did not consider the number of medical departments available for treatment for the geriatric hospital selection because unnecessary medical treatment may occur due to the nature of the elderly and because the hospital is specialized for the elderly. Third, this study limited the candidates to large geriatric hospitals in Korea. In Korea, the number of people aged 65 or older is estimated to increase from 7.381 million (14.3%) in 2018 to 18.813 million in 2050 and is forecasted to account for 41.0% of the total population in 2060. The geriatric hospital derived based on this information is Hyoja Geriatric Hospital in Yongin, Korea. As shown in [Table 1] below, the hospital opened in 1997 and provides medical treatment for neurology, psychiatry, rehabilitation, internal medicine, family medicine, and general medicine. The hospital had 270 beds but is currently operating 360 beds. The area of the hospital site is 8,426,00 m² and the total floor area is 13,683.74 m², so it satisfies all the prerequisites to conduct this study.

Table 1. Hyoja geriatric hospital connectivity analysis

Opening day	1997
Medical	Neurology, Psychiatry, Rehabilitation Medicine, Internal Medicine, General Medicine
Number of beds	360
Floors	5
Site / Total floor area	8,426,00 m2 / 13,683.74 m2
Images	

3.2. Analysis method

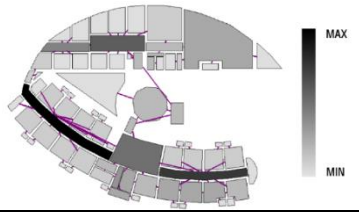
This study performed a hierarchical analysis of the lower floor space of a large geriatric hospital including the outpatient and central medical treatment departments. First, this study grouped the spaces on the lower floors, which include the outpatient department, central medical treatment department, and other public spaces in the hospital. However, the scope of analysis included all of the floors that include the outpatient and central medical treatment departments. Second, this study divided the space into convex spaces for spatial hierarchy and cognitive analysis based on the drawings of the hospital. Also, when dividing the spaces, visual blocking in spaces of the same nature was considered as one convex space. However, corridors were excluded from spaces of the same nature. Third, S3 Convex Analyzer was used to derive the space syntax indicators based on the unit spaces derived above.

3.3. Analysis results and discussion

The analysis results and discussion of the lower floor planning for the large geriatric hospital in this study are as follows.

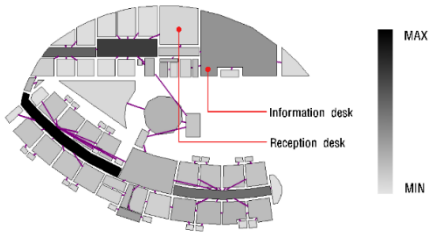
First, the results of analyzing the connectivity of the lower floors of the large geriatric hospital in this study are as follows. As mentioned above, if the convex value is high, the connectivity is high and may result in congestion. Therefore, this may cause problems for the elderly with reduced physical abilities. As a result of deriving the connectivity to the lower floors, the spaces corresponding to the medical departments and wards showed the highest values, and the minimum and maximum values of connectivity were 1 and 13, respectively. The large deviation between the minimum and maximum values is due to the subdivision of medical departments, the enlargement of geriatric hospitals, and the overlapping of the supporting lines leading to other facilities, and may lead to potential problems. This may cause discomfort to the elderly with low spatial awareness due to problems caused by the congestion of circulation.

Table 2. Hyoja geriatric hospital connectivity analysis

Min.	Max.	Avg.	Max Convex Top 5	
1	13	2.25	Lower left corridor of the medical departments, lower right corridor of the medical departments, central hall, upper left of the ward, central hall	

Second, the reception and the information desk on the lower floor of the hospital in this study should have high control values. However, as shown in [Table 3], the control values of these areas are 0.45 and 2.83, respectively, and the reception desk shows a low control value. This means that the connectivity to adjacent convex spaces is low and that the reception desk is not located on the main circulation. Therefore, the reception desk of Hyoja Geriatric Hospital is not located on the main circulation due to the low connectivity of the convex space. This should be considered in the process of designing large geriatric hospitals in the future.

Table 3. Hyoja geriatric hospital control value charts of axial lines in contact with analysis target

Reception Desk	Information Desk
0.45	2.83
	

Third, as shown in [Table 4], the convex spaces of the outpatient department in large geriatric hospitals should have a high local integration because the primary users are elderly patients. The results show that the local integration of medical treatment and waiting spaces were higher than adjacent convex spaces. However, a more diversified analysis of local integration will be necessary because three convex spaces need to be considered to use circulation.

Table 4. Hyoja geriatric hospital analysis of local integration

Min.	Max.	Avg.	Max Convex Top 5	
0.33	2.93	1.34	Lower left corridor of the medical departments, central hall, Lower right corridor of the medical departments, Upper central corridor of the ward, Upper left corridor of the ward	

Fourth, [Figure 1] shows the intelligibility derived from this study, and there may be difficulties in using spaces with values below 0.6. This is because of the increase in convex unit spaces due to the enlargement and subdivision of geriatric hospitals. However, this is not just a matter of larger hospitals but the result of the arrangement and hierarchy of convex unit spaces. Therefore, it is necessary to design circulation hierarchies suitable for elderly patients by considering spatial hierarchy and cognition in the process of designing large geriatric hospitals.

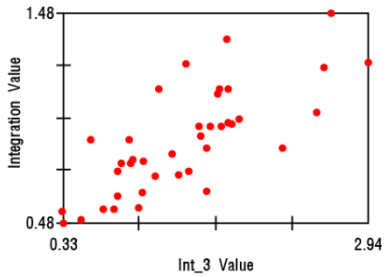


Figure 1. Hyoja geriatric hospital Spatial structure clearness diagram

In summary, thorough consideration should be given to planning facilities for the elderly with reduced physical and spatial abilities. However, insufficient consideration was given to the spaces inside geriatric hospitals as they become larger and subdivided, so many geriatric hospitals may be inconvenient for the elderly. Therefore, this study quantitatively derived the relationship between each unit space in the lower floors of an actual geriatric hospital. As a result, to minimize the possibility of circulation congestion for elderly patients, it is necessary to separate circulation by considering convex spaces and increasing the space utilization and awareness of the elderly. In this regard, this study quantitatively derived the relationship between each unit space in the lower floors of an actual geriatric hospital and suggests that diversified analyses and reviews are necessary to prevent congestion and increase space utilization and awareness as the primary users of geriatric hospitals are the elderly.

4. Conclusion

This is a basic study for planning lower floors that include the outpatient departments, central medical treatment departments, and public spaces in large geriatric hospitals. The study analyzed the adequacy of the locations of these spaces according to the classification criteria in a large geriatric hospital in Korea. The main findings are as follows. First, in terms of the connectivity of the lower floors, the corridors and waiting areas near the medical departments showed high values. Also, as the medical departments in the outpatient department become more subdivided, problems may occur due to the high deviation between the maximum and minimum connectivity. The circulation overlap between that of the patients

and the employee may also contribute to the increase in connectivity. To solve this problem, guidance signs should be planned for the elderly to prevent congestion in spaces with high connectivity. Second, although the reception desks and information desks of large geriatric hospitals should have high control values, some hospitals show low control values. This is because of the low connectivity to adjacent convex spaces as these areas are not located on the main circulation. This detail should be considered when designing large geriatric hospitals in the future. Third, the intelligibility derived through this study was unacceptable, showing a value of below 0.6. This is because of the increase in convex unit spaces due to the enlargement and subdivision of geriatric hospitals. However, this is not just a matter of larger hospitals but the result of the arrangement and spatial hierarchy of convex unit spaces. Therefore, when designing large geriatric hospitals, it is necessary to consider the hierarchy and cognition of spaces by designing spatial hierarchies that are suitable for the elderly. This study is valid as an analysis of the spatial planning of geriatric hospitals that are becoming larger and subdivided as we enter super-aging societies. However, the space syntax convex spaces used in this study have limitations as it does not consider physical distances and sizes. Therefore, various studies should be conducted in the future to improve the results of this study.

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