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A Study on Spatial Configuration of Waiting Room in Geriatrics Hospital

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Abstract: Modern society today is increasingly becoming an aging society and increases in the elderly population have led to the onset of a variety of problems. Due to the concentration of efforts to solve medical problems by quantitatively increasing the number of medical welfare facilities for the elderly, efforts to further develop its associated qualitative aspects have been largely lacking. In the case of out-patient departments of Geriatrics hospitals, despite the impact that the spatial configurations of a waiting room have on the use and perceptions of the space, spatial hierarchy analyses regarding different types of waiting room configurations are largely lacking. In light of this, this study undertook a spatial hierarchy analysis of the types of waiting rooms found in Geriatrics hospitals for the purpose of establishing basic research material to be applied to the designs of Geriatrics hospitals. This study made use of J-graph and Space Syntax to undertake spatial analyses. Upon doing, so, the following conclusions were reached. First, the waiting rooms of Geriatrics hospitals included in out-patient departments were found to take on a tree structure which is known to be highly visible and hierarchical. The results of analyzing connectivity indicated high levels of connectivity between waiting rooms and the hallways adjacent to the waiting rooms. The results of analyzing the control levels of the reception/billing space indicated that centralized structures presented the highest control levels. This was thought to be the case due to the concentration and distribution of waiting rooms. The results of analyzing spatial structure intelligibility indicated that centralized structures were more intelligible than distributed structures. This meant that centralized structures were more easily usable by elderly individuals. However, as Geriatrics hospitals become larger in size to meet the increasing numbers of elderly people, the planning of waiting rooms to embody centralized structures will likely present challenges. In the future, there is expected to be a greater demand for more appropriate configuration and distribution of the waiting rooms in Geriatrics hospitals.

Key words: Geriatrics hospital, types of waiting room, Space Syntax, spatial hierarchy, intelligibility, centralized structures

INTRODUCTION

Recent developments in science and medical technologies have extended the average lifespan of humans. In addition, birth rates have been falling. These factors have contributed to modern societies becoming increasingly aging societies. According to statistics published by the National Statistical Office in 2015, the proportion of the elderly of the total population reached 7.3% in 2000 at which point Korea had already began to become an aging society and in 2015, the proportion of the elderly increased to 13.1%. These statistics point to the fact that this aging of Korean society will continue to accelerate. Such rapid rises in the elderly population may result in a number of different problems in which those problems can be further classified into 4 categories: housing problems of the elderly, leisure problems of the elderly, home care welfare facility problems and medical problems (Kim *et al*., 2003; Choi, 2000; Kim, 2006). Due to the concentration of efforts to solve medical problems by quantitatively increasing the number of medical welfare facilities for the elderly, efforts to further develop associated qualitative aspects have been largely lacking.

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Geriatrics hospitals, a type of medical welfare facility for the elderly include out-patient departments that administer forms of recuperative treatment for out-patients. Due to such aspects, Geriatrics hospitals must consider the characteristics of both recuperation and treatment options. Especially, as facility users are elderly individuals, characteristics associated with the elderly must be reflected in the building plans of Geriatrics hospitals (Lee and Jeon, 2008). The most obvious characteristic of the elderly is that they experience failings and declining abilities associated with the process of aging. Due to the effects of aging, the elderly typically has lower spatial intelligence than members of the general population. In light of this, geriatric hospitals must be designed to help elderly individuals who lack spatial intelligence to easily understand the spatial configurations of the hospital. Especially, in the case of out-patient departments in which waiting rooms are present, elderly individuals may present differences in understanding spatial configurations according to the different types of waiting rooms. The composition of the waiting rooms of Geriatrics hospitals is one element that determines spatial comprehension by the elderly. However, studies regarding different types of spaces such as different types of waiting rooms that are needed to undertake spatial analyses of Geriatrics hospitals are largely lacking (Hong and Lee, 2009).

Consequently, this study undertook a spatial hierarchy analysis of the different types of waiting rooms of Geriatrics hospitals for the purpose of establishing basic research materials for further use in the planning of spatial configurations in Geriatrics hospitals.

Methods and scope of research: This study undertook an analysis regarding the types of waiting rooms of Geriatrics hospitals and Geriatrics hospitals in actual existence were selected and further subjected to spatial hierarchy analyses regarding their types of waiting rooms. In doing, so, the following methods of research were applied.

First, while reviewing past studies, the characteristics of the elderly from a spatial standpoint were studied and the theories behind the concepts of Geriatrics hospitals and the compositional methods of waiting rooms were studied. In addition, J-graph and Space Syntax, the tools used to undertake the quantitative spatial hierarchy analysis were studied. Second, the Geriatrics hospitals to be subjected to further analysis were selected. Upon doing, so, the selected hospitals were each classified into two types according to the types of waiting rooms. Third, according to the type of waiting room, the selected Geriatrics hospitals were subjected to analysis using J-graph and the results of the analysis were used to study the characteristics of spatial compositions. Based on J-graph, a method of spatial hierarchy analysis known as Space Syntax was applied and based on this, usage rates, spatial awareness and accessibility were analyzed.

The Geriatrics hospitals selected in this study all had 100 beds or more. This condition was included in light of the fact that the minimum number of beds of a general hospital is set to be 100 beds or more. The scope of analysis of the Geriatrics hospital was limited to the floor that included the waiting area, out-patient department and central exams department.

Characteristics of elderly individuals: Due to the effects of aging, elderly individuals often experience a number of changes. Among these changes, the characteristics of the changes associated with spatial forms were classified in this study. Characteristics associated with the elderly regard changes in physical characteristics, psychological characteristics and cognitive characteristics (Lee and Kim, 2009; Song and Choi, 2009). Details regarding these changes are summarized as follows.

First, physical characteristics are regarded as the most representative point of change in the aging process of humans. Physical characteristics related to spatial configurations include lowered walking ability, lowered capacities of responding to actions and a decline in visual capacity due to declining levels of metabolism and musculo-skeletal disorders. Spatial pathway planning activities that consider such physical characteristics seek to promote ease of perception and access.

Second, psychological characteristics associated with the elderly include difficulty in adapting to new environments, lowered problem solving abilities, greater degrees of timidity and psychological dependencies. The elderly typically finds it difficult to adapt to new environments and the reduced ability of the elderly to learn new things and solve problems make this particularly, so. These aspects may result in increasing levels of psychological dependency by the elderly and may also become psychological obstacles that impede the use of new spaces by the elderly.

Third, cognitive characteristics associated with the elderly are often related to lowered cognitive ability to discern objects due to loss of dark adaptation capacities, impaired color perception and vision. The amount of information the elderly is able to acquire is also less than members of the general population. Due to the fact that these aspects may result in problems in using 3-dimensional spaces that are mixed with various forms of information, spatial designs must consider the cognitive characteristics of the elderly.

The concept and composition of Geriatrics hospitals: Geriatrics hospitals are largely defined as facilities that provide medical services usually for elderly individuals that are equipped with personnel and facilities as

designated by the Ministry of Health and Welfare. The facilities are operated to treat patients close to death or patients in need of treatment for and recuperation from geriatric diseases. Geriatrics hospitals are somewhat in between nursing homes for the elderly and general hospitals.

The composition and classification of Geriatrics hospitals slightly vary according to the researchers of different studies. In this study, Geriatrics hospitals were divided into the Out-patient Care Department, Central Exams and Treatment Department, Treatment Ward, Management Department and Supply Department. More specifics regarding the spatial composition of each are as shown in Table 1. Among the different constituent elements of the hospital, the Out-patient Care Department features a space in which out-patients are examined by doctors and are provided with counseling, exams and treatment. The department also typically includes a daytime care center to observe and care for patients an Emergency Care Department for emergency treatment and a public space that includes waiting rooms and restrooms (Bae and Kim, 2009; Lee *et al*., 2015; Park and Hwang, 2017).

Classification of waiting room types: As shown in Table 2 the general types of waiting rooms of hospitals in general can be divided into center forms and widespread forms. Center forms can further be divided into centralized forms and distributed forms according to degrees of centralization (Park and Park, 2001).

First, typical centralized forms feature a form that arranges waiting rooms to the center of the out-patient treatment department. Compared to distributed forms, centralized forms have larger waiting rooms. This means that waiting rooms are shared by patients having a number of different illnesses. The travel distances in centralized forms are shortened due to travel distances along pathways taken to exam rooms, reception/billing areas and other locations becoming shorter. However, due to the mixing of patients of varying illnesses in one location, waiting rooms may become congested.

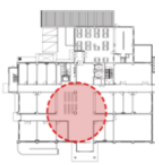
Second, typical center distributed forms feature a form in which a large waiting room is located at the center and a number of smaller waiting rooms that are distributed across each examination zone, each of which has different purposes and functions. The large waiting room in the center is normally where the reception/billing area is located and is also used by those waiting to be examined. In the smaller sized waiting rooms, people usually only use the space to wait for examinations. Due to relatively less connectivity present between the smaller waiting rooms, the spaces are subject to less congestion. Despite this, however, this form entails longer overall travel distances.

Third, typical widespread distributed forms feature a form in which waiting rooms are distributed and arranged in each of the examination zones. This form is similar to that of the central distributed form and does not entail large variations when comparing size. This form encompasses comparatively smaller waiting rooms and can more easily deal with privacy issues and is independent from the other areas of the hospital. However, should the number of patients rise, this form results in inconveniences and travel distances to examination supporting departments become longer.

Table 1: Organization and classification of Geriatrics hospitals

Departments	Classification
Out-patient Treatment	Out-patient, emergency treatment, daytime care, public space
Central Exams and Treatment	Clinical testing, radiology, rehabilitation treatment, public space
Treatment Ward	Patient space, nurses space, public space
Management Department	Director's office, administrative offices, medical records, public space
Supply Department	Pharmacy, cafeteria, central supply, morgue, convenience facilities, public space

Table 2: Classification of waiting room

Centralized form	Center distributed form	Widespread distributed form
		

MATERIALS AND METHODS

The concept of J-graph and analysis methods: J-graphs concern a type of diagram that visually represents the structural hierarchies of a space in which the arrangements of the spatial depths of nodes ina space are used to represent forms of spatial connections using the nodes and the links of the nodes. The nodes of this study were convex spaces in which convex spaces refer to spaces that are not visibly obstructed. As shown in Table 3, types of J-graphs can be classified as tree types and ring types. Tree types have hierarchical structures and are consecutive structures having continual

Table 3: Type of J-graph

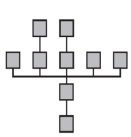
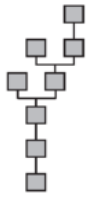
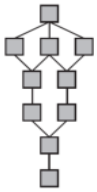
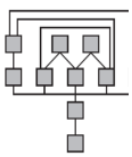
Tree type		Ring type	
Shallow tree	Tall tree	Deep ring	Shallow ring
			

Table 4: A general outline of surveyed hospitals

Name of hospitals	No. of beds	Floors (above/under)	Total area (m²)	Type of waiting room
Tongyeong Sanitorium Hospital (KT)	155	4/1	6763.13	Centralized form
Daegu Siji Geriatrics Hospital (DD)	160	6/1	4977.20	
Bobath Memorial Hospital (BK)	400	5/2	24897.92	Center distributed form
Hyoja Geriatrics Hospital (YY)	292	5/0	7817.45	
Eunhye Hospital (EI)	250	6/1	7409.775	Widespread distributed form
Jeonju City Hospital for the Elderly (JJ)	199	4/0	3535	

properties and present higher visibility than perceptions of space. Ring types have structures that manifest social characteristics. Due to the high autonomy of its spatial structures, ring types present higher perceptions of space than spatial visibility (Yoon and Kim, 2014).

J-graphs were developed by first, zoning specific spaces based on the floor plans of subjects, dividing convex spaces and finally developing the J-graph. The division of convex spaces accounted for areas directly used by elderly individuals and the inclusion of management department sections such as reception areas that are used to manage the waiting areas.

Space Syntax concept and analysis method: Space Syntax refers to an analysis technology used to reveal the relations of spatial arrangements and involves the quantitative analysis of the connections among each of the nodes. The process involves an analysis of only the connections between nodes and disregards the size, color and furniture of a space. Detailed explanations regarding the assessment indexes developed from Space Syntax were summarized below (Park *et al*., 2011; Hwang *et al*., 2017).

First, connectivity refers to the degree in which a space is connected and is concerned with the number of axis lines that connect a space to a nearby space. Spaces having high connectivity can be regarded as being located in important positions and are frequently used. Second, control levels refer to the control levels of a space compared to its adjacent spaces. Spaces with high control levels indicate that the space is subjected to large amounts of control by its nearby spaces and also indicate that the space exerts large amounts of control over nearby spaces. Third, general integration level is an index that represents the relation between a random node with the entire space. A space having a high general integration level is typically used as a movement pathway by individuals and is easily accessible by other spaces. Fourth, local integration level is an index that presents the characteristics of a space in which values are calculated upon considering level 3 spatial depth of a space. The localized spatial arrangement structure characteristics regarding only a few levels of spatial depth of a concerned space are presented. Fifth, spatial intelligibility presents the degree to which an entire structure can be perceived through the correlations with connectivity that present general and local integration properties. Large correlations between two parameters signify greater ease and intelligibility regarding the understanding of spatial structures (Kim, 2008).

This study applied Space Syntax to undertake an analysis of the perception and use of space in Geriatrics hospitals. To undertake the analysis, S3 Convex Analyze, used in a related study was applied.

Selection of subjects of analysis: The subjects of this study as mentioned earlier included Geriatrics hospitals having 100 beds or more and according to the types of waiting rooms, two sites were each selected. An overview of the selected Geriatrics hospitals is presented in Table 4.

RESULTS AND DISCUSSION

J-graph analysis: The Out-patient Departments of Geriatrics hospitals were mostly located in the first floor or underground floor to allow out-patients to conveniently access facilities entering from outdoors. These spaces should be easily perceived and accessible by elderly individuals in a manner that considers their physical characteristics. Because of this, rather than focusing on spatial autonomy it is thought that out-patient departments should embody tree type structures that have high visibility due to their continuity and hierarchical nature.

The J-graph results of the Out-patient Department of Geriatrics hospitals are presented in Table 5. The analysis results presented highly visible tree type structures. Particularly, depending on the types of waiting rooms, centralized forms presented shallow tree type structures whereas center distributed forms and widespread distributed forms presented tall tree type structures. Centralized forms presented a structure in which spatial connections were made in the order of the lobby, waiting room and exam rooms and central examinations departments from the entrance and exit in which the waiting rooms were large. Due to their large waiting rooms, centralized forms were considered appropriate for small and medium sized hospitals due to its shorter travel distances. Although, the J-graph of the center distributed forms presented similar analysis results to the J-graph of the centralized forms, the distributed nature of its waiting

Table 5: J-graph of out-patient department in surveyed hospitals

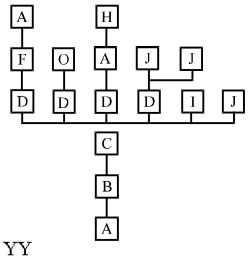
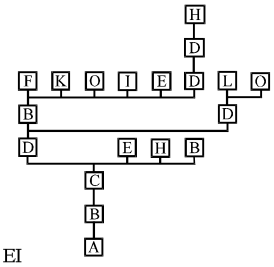
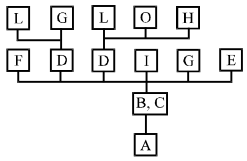
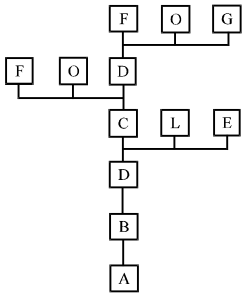
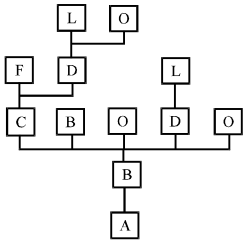
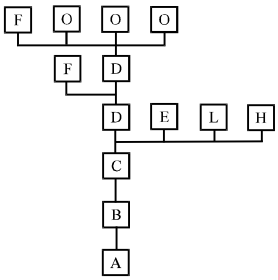
KT	DD	BK
Centralized form	Centralized form	Center distributed form
		
YY	EI	JJ
Center distributed form	Widespread distributed form	Widespread distributed form
		

Table 6: Connectivity analysis

Name of hospital	Type of waiting room	Connectivity priority value
KT	Centralized form	Waiting room (8), right upper hallway of waiting room (7), left upper hallway of waiting room (7), right lower hallway of waiting room (4)
DD		Waiting room (12), upper hallway of waiting room (8), general examination center (8), general affairs office (4)
BK	Center distributed form	Waiting room (16), left hallway from central exam (11), left hallway of waiting room (9), central waiting room (7)
YY		Waiting room (7), left hallway of waiting room (6), right hallway of waiting room (5), lower hallway of waiting room (4)
EI	Widespread distributed form	Central waiting room (10), waiting room (4), right hallway of waiting room (4), upper hallway of center area (3)
JJ		Central waiting room (6), lower hallway of waiting room (6), waiting room (5), right hallway of center area (4)

rooms made it appropriate for use in large sized hospitals. In addition, due to its distribution of small waiting rooms, center distributed forms entail fewer chances of interaction between patients having different illnesses and lessen the chances of infection.

IIncreases in the size of Geriatrics hospitals presented increases in spatial depth and No. of nodes due to greater segmentation of examination fields and increases of public space:

A = Entrance/Exit
B = Lobby
C = Waiting room
D = Hallway
E = Reception/billing
F = Exam room
G = Recreations room
H = Convenience store/restaurant
I = Pharmacy
J = Social contributions office
K = Treatment room
L = Restroom
O = Central exam

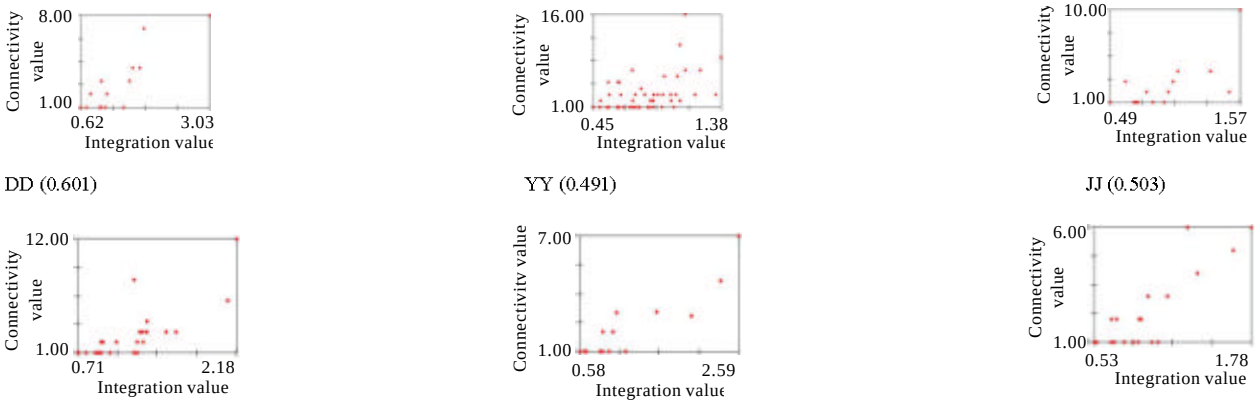
Space Syntax analysis: First, the results of analyzing connectivity are shown in Table 6. Overall, waiting rooms were found to be located at important locations of pathways and are expected to present high frequency of use. In addition, centralized forms entailed large waiting rooms at the center of the structure in which the hallways connecting the waiting rooms presented high connectivity. Center distributed forms included a large

Table 7: Control value analysis

Name of hospitals	Type of waiting room	Control level average value	Control level maximum value	Reception/billing space control value
KT	Centralized form	1.048	6.111-Right upper hallway of waiting room	0.254
DD		1.042	6.833-Central Examination Center	3.083
BK	Center distributed form	1.060	14.333-Out-patient exam waiting room	0.476
YY		1.033	5.143-Left hallway of waiting room	0.200
EI	Widespread distributed form	1.000	8.333-Central lobby	0.250
JJ		1.000	4.700-Out-patient waiting hallway	0.200

Table 8: Intelligibility analysis

Centralized form	Center distributed form	Widespread distributed form
KT (0.707)	BK (0.173)	EI (0.432)
DD (0.601)	YY (0.491)	JJ (0.503)



waiting room and the distribution of a number of small waiting rooms. This form presented high connectivity in the hallways connecting the main waiting room and auxiliary waiting rooms. Although, presenting similarities to the center distributed form, the widespread distributed form included small waiting rooms that did not vary a great deal in size. This form presented high connectivity in a manner similar to the center distributed form in which areas connecting the central waiting room with other waiting rooms presented high connectivity. In light of these aspects and in light of the differences in usage frequencies of spaces according to the waiting rooms of Geriatrics hospitals, the designs should entail an appropriate distribution and combination of convexes having waiting functions.

Second, the results of analyzing control levels are shown in Table 7. The reception/billing space, an area that needs to be capable of managing its nearby spaces from the Out-patient Department should have a high level of control. The center distributed form presented high average values of control levels. Of the values, the Out-patient Department of the Bobas Memorial Hospital (BK) was found to present the maximum values. In the case of centralized forms its reception/billing spaces presented higher than average values of control level indicating an ease of controlling its nearby spaces. The widespread distributed form presented the lowest control levels which indicated that it would entail many difficulties with regards to management. In light of the results, the waiting rooms of centralized forms were found to present advantages with regards to the control of elderly patients.

Third, the results of analyzing the spatial structure intelligibility of the waiting rooms of Geriatrics hospitals are shown in Table 8. The results indicated high intelligibility regarding the centralized forms. This denotes that centralized forms are easy to spatially perceive. On the other hand, center distributed forms and widespread distributed forms presented disadvantages regarding spatial perception. The reason behind this was most likely due to the separate placement of waiting rooms. In addition, the analysis results indicated a tendency in which spatial structure intelligibility became lower as the sizes of the hospitals increased. The reason behind this was due to increases in convexes such as related departments and convenience facilities that were entailed in the increases in hospital sizes.

CONCLUSION

This study undertook an analysis of the hierarchy and spatial perceptions of different types of waiting rooms found in the Out-patient Departments of Geriatrics hospitals. Quantitative spatial analyses were undertaken using J-graph and Space Syntax. In doing so, the following conclusions were reached in this study.

First, the structures of the floor plans of Out-patient Departments of Geriatrics hospitals having waiting rooms were found to be tree type structures. J-graphs according to types of waiting rooms indicated shallow tree, tall tree and tall tree structures, respectively in the centralized form, center distributed form and widespread distributed form. The floor plans having high visibility were thought to have been implemented out of consideration for the characteristics of the elderly.

Second, the Out-patient Departments of Geriatrics hospitals presented the characteristics of high usage frequencies in which high connectivity was found in important locations along pathways of waiting room convexes. For forms having distributed waiting rooms it is expected to be difficult to collect spatial information due to congestions. Clear pathway planning that takes into account the locations of management departments and exam areas is needed to resolve this.

Third, the reception/billing spaces of out-patient departments of Geriatrics hospitals should be able to easily control nearby spaces. The centralized form presented high control levels of the reception/billing space. This meant that the reception/billing spaces of centralized forms entailed ease of controlling and managing nearby spaces. In addition, the widespread distributed form presented low control levels which indicated that it would cause many difficulties with regards to management.

Fourth, the results of analyzing spatial structure intelligibility indicated that centralized forms were more intelligible than distributed forms. This meant that centralized forms were more easily usable by elderly individuals. However, as the sizes of Geriatrics hospitals are increasing to meet the demands of a growing elderly population it is thought that it will be difficult to apply types of waiting rooms found in centralized forms. In light of this, appropriate combinations and arrangements of waiting rooms are thought to be necessary.

The purpose of this study was to conduct a spatial hierarchy analysis of the types of waiting rooms found in the Out-patient Departments of Geriatrics hospitals in which the characteristics of the types of waiting rooms were assessed. Accordingly, this study is significant in that it provides basic research materials for building plans in the future. However, in light of the limitations of the methods used in this study whereby the methods were limited to analyzing flat surfaces and also did not reflect physical area, studies in the future that improve upon such limitations are needed.

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REFERENCES

Bae, S.M. and S.T. Kim, 2009. A study on the spatial structure and human traffic efficiency geriatric hospital. Korean Inter. Des. Soc. Conf. Proc., 2014: 109-112.

Choi, M.K., 2000. A study on the analysis of housing environments of the elderly households and its suggestions in preparation for aging society. J. Archit. Inst. Korea Plann. Des., 16: 29-38.

Hong, G.J. and Y.H. Lee, 2009. A study on the residential space organization system of the elderly care facilities. J. Korea Inst. Spatial Des., 4: 95-104.

Hwang, H.J., H.W. Lee and C.O. Oh, 2017. A preliminary study on the spatial configuration of geriatrics hospitals according to the waiting space type. J. Creative Sustainable Archit. Built Environ., 7: 1-8.

Kim, S., 2008. A study of structural evaluation of the FPS game map using space syntax. J. Korean Soc. Des. Sci., 21: 117-118.

Kim, S.H., J.H. Lee and K.H. Kang, 2003. A study on the architectural planning of geriatric hospitals. J. Korean Inst. Inter. Des., 36: 68-75.

Kim, Y.S., 2006. A study on linkages health and welfare services in home care for the aged. Korean Assoc. Health Med. Sociology, 19: 71-96.

Lee, H.W. and S.T. Kim, 2009. A study on the hierarchy in spatial configuration of geriatrics hospital. Korean Inst. Inter. Des. J., 18: 183-190.

Lee, J.H., K.H. Choi, K.W. Choi and Y.S. Park, 2015. A study on quality of life improving of hospitalized elderly patients. Asia Pac. J. Multimedia Serv. Convergent Art Humanities Sociology, 5: 141-153.

Lee, M.S. and H.W. Jeon, 2008. A study on the characteristics of rehabilitation for space configuration in the special clinic for the elderly. J. Korean Inst. Inter. Des., 17: 120-129.

Park, J.K., C.O. Oh and S.T. Kim, 2011. A study on the hierarchy and relationship in spatial configuration of nursing homes for the elderly. J. Korean Inst. Inter. Des., 20: 249-258.

Park, J.Y. and J.S. Park, 2001. A study on the architectural planning of outpatient clinic department in children's hospital: Focused on the movement and behavuor of children patient. Korea Inst. Healthcare Archit., 7: 75-68.

Park, S.J. and Y.H. Hwang, 2017. Death awareness and death preparation experiences in hospitalized elderly people in a Long-term care facility. Intl. J. Elderly Welfare Promotion Manage., 1: 21-24.

Song, H.J. and S.H. Choi, 2009. An evaluation of treatment conditions at the nursing homes for the aged with consideration of their characteristics: Focusing on the municipal nursing homes in Seoul. Korean Inter. Des. Soc. Conf. Proc., 11: 204-209.

Yoon, S.H. and S.T. Kim, 2014. A study on the spatial configuration of elderly care facilities according to function and corridor type. J. Reg. Assoc. Archit. Inst. Korea, 16: 96-99.