A Study on the Correlation between Viewing Behavior and Exhibiting Methods in Museums - Focusing on Viewing Behavior on Weekdays and Weekends in Medium Sized History Museums in Korea -

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Abstract
Currently museums in Korea are experiencing various kinds of trial and error, as there have not been systematic plans to build museums. Among them, unexpected flow of human traffic produces negative side effects such as 'viewing abandonment' rather than behavior optimization through well-planned physical environments of museums because of high visitor density on weekends. However, the current status of not mentioning the causal relationship between the problematic phenomena and exhibiting methods is not identified.

Accordingly, this study tried to understand the correlation of viewing behaviors on weekdays or weekends with the exhibiting method from the perspective of visitor density. For the purpose of this study, the authors tried to identify the correlation of viewing behaviors on weekdays or weekends with the exhibiting method from the perspective of quantitative measurement elements. According to the analysis results, viewing behaviors in museums with wall display system were affected by spatial structure, while those with wall and island display system were heavily affected by visitor density.

Through this study, it may be possible to provide indexes for museums proposing optimized viewing behaviors for social education.

Keyword: museum; space syntax; exhibiting method; visitor density; visitors' viewing behavior

1. Preface
1.1 Background and Purpose
The history of Korean museums started with the 'Jaesil Museum' in 1909. Quantitative growth was seen in the 1990s when local governments were introduced in Korea¹ but, qualitatively they have been experiencing many trials and errors because of the absence of a systematic plan for the building and operation of museums. Especially, close consideration of viewing behaviors was not made so museums do not properly perform their original function, which is social education. Among them, the unexpected flow of human traffic because of high visitor density on weekends produces negative situations such as 'viewing abandonment' instead of behavior optimization through well-planned physical environments of museums. However, the current status of not mentioning the causal relationship between the problem and exhibiting method is not identified.

Accordingly, this study tried to understand the correlation of viewing behaviors on weekdays or weekends with exhibiting methods from the perspective of visitor density. Through this study, it may be possible to provide indexes for museums proposing optimized viewing behaviors for social education.

1.2 Research Scope and Subjects
For the purpose of this study, medium sized² history museums which were built after the 1990s and located in the Seoul capital area of Korea were selected. The reason why the authors limited the time of establishment of museums as after 1990 is because Korea entered a time of economic stability through industrialization and a desire for culture and art started to emerge in this period.

Additionally, with the full-scale introduction of a system of local government, many museums were built for identity discovery and the public relations of each local government.

History Museums were selected because of the exhibiting methods they used. The purpose of this study is to understand the correlation of viewing behaviors on weekdays and weekends with the exhibiting methods of museums. While art museums use the wall type display system and science museums mainly use the wall and island type, history museums...
use both methods so they are appropriate subjects to perform a study from the perspective of visitor density and exhibiting methods.

As the purpose of this study is to understand the effects of difference in visitor density between weekdays and weekends concerning viewing behaviors, the subjects of the study were limited to frequently used museums in the Seoul capital area considering the accessibility of visitors.

In this study, Suwon Hwaseong Museum (WM-1), Shilhak Museum (WM-2) and Heo-jun Museum (WM-3) were selected as wall type display system subjects and Jeongok prehistory Museum (WIM-1), Sejong-Chungmu Story (WIM-2) and the National Folk Museum of Korea (WIM-3) were selected as wall and island type display system subjects.

1.3 Research Method

For the purpose of this study, museums were classified as ‘wall type display system’ (WDS, hereafter) and wall and ‘island type display system’ (WIDS, hereafter) according to the exhibiting method 3.

The authors performed observations on weekdays and weekends separately to understand the viewing behaviors of visitors. They took snapshots to identify visitor density and traced the people’s circulation (people following) to identify viewing speed, abandonment rate of viewing the exhibits, abandonment rate of visiting the exhibition space, persistent level of viewing the exhibits, and persistent level of staying in an exhibition space. The results were then compared with the integration value in the exhibition space and that in the public space through an analysis of the intelligibility value in the public space based on space syntax 4.

Integration value 4 is the index showing the integration ratio of a specific space to a whole space. As there is a high probability that viewers will visit a highly integrated exhibition space, it can be used for the estimation of visitor density.

This study rated 6 sub factors of viewing behaviors on weekdays and weekends such as visitor density, viewing speed, abandonment rate of viewing the exhibits and visiting exhibition space, persistence level of viewing the exhibits and staying in an exhibition space, time of viewing per item and time of viewing per convex as 7 stages based on the space of the convex and then compared them with the integration analysis results which were also rated as 7 stages. The differentiation between cases of weekdays and those of weekends in this result is derived.

In order to interpret the causes of analysis results 5, the intelligibility 5 of each subject museum was analyzed and compared with viewing behaviors that had already been analyzed. Intelligibility is the index showing how clearly the hierarchical system of total space and exhibition spaces can be understood. When intelligibility is low, it is difficult to find the way and consequently it may give diversified space experiences to viewers although they may be somewhat confused. When intelligibility is high, it will provide information to understand the whole space easily. In highly intelligible museums, viewers can find their way easily, however such museums may give viewers monotonous and similar experiences.

For observation study, it was judged that a vacation period would be the best time to observe museum visitors, because of the relatively higher number of visitors going to museums during such period. Thus, the two months of July and August in 2012 were selected as the period of study and observations were made during this period.

For observation methods, people following and snapshots were used. The principle was to make observations on the same days of the week excluding the days the museums were closed, and the authors performed observations separately for weekdays and weekends. Considering the opening and closing hours of museums, observations were made from 10 in the morning to 5 in the afternoon.

For people following observations the researcher traced the circulation of the subject visitor and recorded his or her path on the floor plan. In this study samples were randomly selected among general visitors, excluding group visitors with guide. In 6 museums, 20 visitors on weekdays and another 20 visitors on weekends were chosen respectively, so the number of total observed visitors is 240. While performing people following observation, snapshots were taken at the same time. The scope of people following was limited to public areas allowing free travel of visitors out of all the spaces of museums. Snapshots included all the visitors in the exhibition space that the subject visited. During people following, the researcher recorded whether the subject had viewed each item and the entry and exit time of each exhibition space according to the circulation of the subject. The distribution of viewers in the exhibition space was recorded twice, when taking a snapshot and at the time of entry and exit of the corresponding convexes.

To calculate the viewing behavior of visitors, the authors measured the area of the convex as an unit space of this study and used it to measure visitor

![Fig.1. Research Method](image-url)
density and persistent level of staying in an exhibition space. Next, the length of exhibits was measured to induce the persistence level and abandonment rate of viewing the exhibits. To calculate the viewing speed and persistence level of visiting an exhibition space, the viewing time of the subject was compared with the length of circulation in the exhibition space and length of exhibits and abandonment rate of visiting exhibition space was determined.

2. Basic Investigation

As seen in Table 1., the exhibition spaces of the museums were distributed on a floor. Visitors of each museum enter the exhibition space and start to view following the instructions of museum staff and guidance banners. WM-1, WM-2, and WM-3 museums have exhibition showcases along the walls. In this study, they are classified as WDS museums. The amount of distribution to unit space by exhibits is low. According to Space Syntax analysis, the average integration value of WDS museums is 0.597, while average intelligibility is 0.189, which places these museums in a higher-than-average group.

WIM-1, WIM-2, and WIM-3 museums place exhibition showcases on the walls and in the middle of the circulation of viewers at a similar rate. In this study they are classified as WIDS museums. The amount of distribution to unit space by exhibits is high. According

| Classification | WM-1 | WM-2 | WM-3 | WIM-1 | WIM-2 | WIM-3 |
|----------------|------|------|------|-------|-------|-------|
| Name of museum | Suwon Hwaseong Museum | Silhak Museum | Heo-jun Museum | Jeongok Museum | Sejong-Chugmu Story | National Folk Museum of Korea |
| Opening year   | 2009 | 2009 | 2005 | 2011  | 2010  | 1993  |
| Location       | Gyeonggi Province | Gyeonggi Province | Seoul | Gyeonggi Province | Seoul | Seoul |
| Display Type   | WDS  | WDS  | WDS  | WIDS  | WIDS  | WIDS  |
| Circulation form | Regulated movement | Regulated movement | Regulated movement | Free movement | Free movement | Free movement |
| Integration    | 0.662 | 0.580 | 0.550 | 0.407  | 0.471  | 0.457  |
| average        | 0.597 |       |       |        |        | 0.445  |
| Intelligibility| 0.250 | 0.185 | 0.132 | 0.051  | 0.052  | 0.060  |
| average        |       | 0.189 |       |        |        | 0.054  |
to Space Syntax analysis, they belong to the lower-than-average group, as the average integration value of WIDS museums is 0.445, average intelligibility is 0.054.

3. Viewing Behavior Study

3.1 Visitors' Spatial Distribution of Circulation

As seen in Table 1., the circulation of visitors and spatial distributions vary between weekdays and weekends. In particular, the ratio of visiting each space and viewing patterns are different on weekdays and weekends.

WM-1, WM-2 and WM-3 showed a relatively similar circulation and spatial distribution on weekdays and weekends regarding the distribution of exhibits. WIM-1, WIM-2 and WIM-3 showed a relatively diversified circulation and spatial distribution on weekdays and weekends according to the distribution of exhibits.

3.2 Visitors' Viewing Behavior Analysis

The quantitative analysis results of viewing behavior in WDS museums and WIDS museums are shown in Table 2. The average value of visitor density in WDS museums is 0.015 people/m², which is lower than that of WIDS museums, while museum viewing speed in WDS museums is 27.251 people/m², which is faster than that of WIDS museums. The average value of abandonment rate of viewing the exhibits and visiting exhibition space in WDS museums is 40% and 39% respectively, which are higher than those of WIDS museums. Persistent level of viewing the exhibits and staying in exhibition space in WDS museums is 0.056 and 0.004 respectively, which are lower than those of WIDS museums. Viewing speed in WDS museums is 26.528m/min on weekdays and 27.920m/min on weekends, while that in WIDS museums is 25.883m/
Table 4. Correlation between Exhibition Space Integration and Viewing Behavior

| Classification Number | WM-1 | WM-2 | WM-3 | WIM-1 | WIM-2 | WIM-3 |
|-----------------------|------|------|------|-------|-------|-------|
| Integration-          |      |      |      |       |       |       |
| Visitor density       |      |      |      |       |       |       |
| Viewing speed         |      |      |      |       |       |       |
| Persistence level of viewing exhibits |      |      |      |       |       |       |
| Abandonment rate of viewing exhibits |      |      |      |       |       |       |
| Persistence level of staying in exhibition space |      |      |      |       |       |       |
| Abandonment rate of visiting exhibition space |      |      |      |       |       |       |
### 4. Correlation between Visitors' Behaviors According to Exhibiting Method and Space Syntax Analysis

#### 4.1 Correlation between Integration Value and Viewing Behaviors of Museums by Type

The correlation between integration value and viewing behaviors of each museum are shown in Table 3. The integration of WDS museums tends to be higher than that of WIDS museums.

#### 4.2 Correlation between Visitors' Behavior and the Integration of Exhibition Space by Stage

(1) Comparison between 7 stages of exhibition space integration and 7 stages of viewing behaviors

The correlation between 7 stages of exhibition space integration and 7 stages of viewing behaviors can be found in Table 4. On weekdays, there is a similarity between the stages of exhibition space integration and stages of viewing behaviors, while there is diversity...
between the stages on weekends. Such tendency is more conspicuous in WIDS museums than WDS museums.

(2) Analysis on difference between 7 stages of exhibition space integration and 7 stages of viewing behaviors
a. The difference between 7 stages of exhibition space integration and 7 stages of viewing behaviors on weekdays ([a] hereafter) and 7 stages of exhibition space integration and 7 stages of viewing behaviors on weekends ([b] hereafter) is shown in Table 4. The deviation on weekdays is smaller than that on weekends and that of WDS museums is smaller than that of WIDS museums.

b. The difference between 7 stages of exhibition space integration and 7 stages of viewing behaviors on weekdays ([a] hereafter) and 7 stages of exhibition space integration and 7 stages of viewing behaviors on weekends ([b] hereafter) is shown in Table 4. WIDS museums showed bigger value than WDS museums.

5. Comprehensive Consideration
This study described that the exhibiting methods of museums might affect the spatial distribution of visitors in museums through the aforementioned analyses and that exhibiting methods of museums could account for viewing behaviors on weekdays and weekends.

WDS museums without island-type showcases showed lower differentiation of convex than WIDS museums, and visitors to these museums had a higher understanding of the structure of exhibition space because they did not experience visual interference from island-type showcases. Therefore, it was easy for visitors to find their way and they tended not to get lost. Thus, as it was relatively easy to move from one unit exhibition space to another, visitors’ viewing speed was relatively fast, and the rate of passing through the unit space was low because they were well aware of the structure of exhibition space. Because of this, visitor density was relatively low, abandonment rate of viewing the exhibits and visiting exhibition space were low, and persistent level of viewing the exhibits and staying in exhibition space was high. Regardless of substantially more visitors on weekends, WIDS museums were affected by spatial structure on weekdays, just as in WDS museums. Because of the nature of such exhibiting method, WIDS museums showed a big difference in visitor density between weekdays and weekends. The visitors’ behavior tends to differ considerably when comparing the behavior on weekdays to that on weekends according to the changes of visitors’ density under the features of this exhibition style.

Therefore, it can be concluded that although viewing behaviors in WIDS museums were affected by spatial structure just as in WDS museums, WIDS museums were affected more by visitor density resulting from viewing traffic than by spatial structure on weekends.

6. Conclusion
For the purpose of this study, observations were performed separately for weekdays and for weekends to understand the corresponding visitor behaviors and then compared with Space Syntax analysis results for correlation analysis. The following are the results of this study.

As WDS museums showed less difference in visitor density between weekdays and weekends, it was found that the viewing behaviors in these museums were determined by spatial structure. Although WIDS museums were affected by spatial structure on weekdays, they were more heavily affected by visitor density owing to viewers’ traffic than spatial structure on weekends.

This suggests that viewing behaviors in museums where viewers’ understanding about exhibition space is low and various kinds of viewing possibilities are provided because of difficult path finding should be affected more by visitor density than those in museums where a similar pattern of viewing is expected because path finding is easy based on the high level of understanding about exhibition space.

Based on the results of this study, it was possible to identify the effects of exhibiting methods on viewing behaviors from the perspective of visitor density.
Notes

1) (Ref-6) The authors reported that more island-type showcases in exhibition space would increase differentiation of the convex, which may lower the intelligibility of the museum. When a convex in exhibition space is differentiated greatly and has a large number of rings, viewers are placed in the situation of having to make a decision to select which ring they will take. When a convex in exhibition space is less differentiated, viewers have a high chance to select the same circulation.

2) The visitor with WDS understands the exhibition space more easily than the one with WIDS, because it is visually open with WDS than with WIDS.

3) When the visibility becomes bigger, perception on the whole space becomes better. Because of this reason then visitor won’t be lost and the probability to have monotonous experience gets lower. When the visibility becomes smaller, perception becomes lower, then they may be lost on the viewing.

4) As this study is to identify viewing behaviors according to exhibiting method, convexes reflecting structural characteristics of exhibits were set as the unit of investigation.

5) Visitor density is the result of dividing the average number of visitors in an exhibition space.

6) Viewing time is the result of dividing the length of viewing circulation within the exhibition room by the viewing time.

7) Abandonment rate of viewing the exhibits refers to the ratio of length of exhibits that the target subjects have not viewed within the total length of all exhibits in each exhibition room.

8) Abandonment rate of visiting the exhibition space refers to the ratio of the targets who abandoned the viewing of the unit exhibition space to all subjects (20 people per exhibition room). (The number of exhibition room targets did not enter/The number of all exhibition spaces).

9) Persistence level of staying in the exhibition space is the result of dividing the viewing time of the survey target by the unit exhibition space. This indicates the degree of the persistence of viewing in the space where the viewing circulation can be established by the survey targets in the unit exhibition space. (Viewing time/ m²).

10) Persistence level of viewing the exhibits is the result of dividing the viewing time of the survey target by the length of the exhibits viewed by the targets. This refers to the persistence of the survey targets' viewing the exhibits.

Integration in the floor where exhibition spaces exist.

The deviation between viewing behaviors on weekdays and integration value in exhibition space.

The deviation between viewing behaviors on weekends and integration value in exhibition space.

Viewing behaviors were classified into 7 stages based on the correlation among integrity viewing behaviors shown in 5.1.

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