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Comparison of the Level of Complexity Floor Plans and Circulation Effective Exhibition to Wayfinding A Target Inside the History Museum

Kittisak Techakanjanakit[1], Yanin Rugwongwan[2], Chumporn Moorapun[3]

Abstract

History museum is a public building that is important part in society as a place of learning. Having an exhibition floor plan is beneficial, as it enables visitors to navigate the museum efficiently and find the information without confusion in searching for what they want to learn. The objective of this research is to compare the level of complexity of floor plans and circulations in a history museum and their impact on targeting performance. This study is an experimental in generality, focused on floor plans and exhibition circulations with varying levels of complexity, measured using Inter-Connection Density (ICD), which is influenced wayfinding performance. A total of 200 undergraduate bachelor degrees students in their 2nd-3rd year were selected as the sample group for this study. Statistical analysis was conducted using Multivariate Analysis of Variance (MANOVA). The experimental results revealed that, the floor plans and circulation of exhibition have a low level of complexity, as measured by ICD, and Control floor-plan facilitated efficient target locating for museum visitors. This is because it minimized wasted time in wayfinding walking. The implementation of certain measures can greatly assist visitors in navigating to their desired exhibition within the museum, making their journey easier. By strategically guiding visitors towards their targeted destinations, unnecessary wandering can be reduced. This not only minimizes the required traversal count to discover the target, but also provides a clear and unobstructed view of the target ahead. Consequently, visitors do not waste time by constantly stopping to observe their surroundings. The bigger the size of the floor plans and exhibition corridors with a high level of complexity and a high ICD value, along with an open floor plan, the more visitors to the museum exhibit have to wayfinding walking their targets. This is because they need to explore the entire exhibition area. Such extensive walking and visiting choices result in wasted time for visitors as they spend more time searching for their intended targets.

Keyword: *History Museum, Wayfinding Performance, Inter-Connection Density.*

Introduction

The study of wayfinding in public building spaces holds significant importance due to the complex nature of high-traffic routes in these areas. Public buildings are designed to accommodate numerous visitors and their diverse activities, resulting in a composition that requires effective navigation and wayfinding systems. Understanding and improving wayfinding within public buildings becomes crucial in ensuring smooth and efficient movement for visitors within these spaces. If visitors cannot find their desired destinations or do not know their location within the building, they can become confused, waste time, and be forced to leave the area (Carpman and Grant, 2002). Wayfinding is a behavioral process in humans that occurs when visitors navigate from their current point of view to their destination. As defined by Passini (1984), wayfinding is a sequential decision-making process consisting of cognitive mapping, decision-making, and decision execution. From the two definitions, it was found that the process of wayfinding covers both internal behavior, such as receiving imagination and making decisions, and

[1]Architecture Program in Multidisciplinary Design Research, School of Architecture, Art, and Design, King Mongkut's Institute of Technology Ladkrabang. Email: bookijoke@gmail.com
[2]Architecture Program in Multidisciplinary Design Research, School of Architecture, Art, and Design, King Mongkut's Institute of Technology Ladkrabang. Email: yanin.ru@kmitl.ac.th
[3]Architecture Program in Multidisciplinary Design Research, School of Architecture, Art, and Design, King Mongkut's Institute of Technology Ladkrabang. Email: kmchumpo@kmitl.ac.th

external behavior, such as the various gestures that occur during wayfinding. Public buildings, such as museums, have not received sufficient attention in terms of studying their design to facilitate target-oriented navigation. However, it is crucial to guide visitors smoothly from one point of the museum to another, ensuring they do not become lost or confused. Visitors should be able to explore various points of interest in a thorough and comprehensive manner. A study conducted by Wineman and Peponis focused on the impact of floor and circulation plans on visitors' experience and found that the arrangement and plans of the floor significantly influenced the ease of finding, viewing, and comprehending museum circulations. The configuration of the floor plan is an essential aspect of the physical environment that directly influences visitors within that space. While the term "floor plan" may have various interpretations, it can be inferred that its significance lies in determining the spatial arrangement, organization, and flow of the museum's plans. The floor consists of areas that are arranged in relation to each other and are connected by circulations. Van Hoogdalem, van der Voordt et al. (1985), Peponis, Zimring et al. (1990), and Arthur and Passini (1992) have stated that the floor plan is often considered in terms of: 1) Size and relative location of space, 2) Relation between separate spaces, 3) Relation between groups of space zoning, and 4) The use of communal space.Weisman (1981) chose to consider the floor plan by looking at the directions. In his research, a card sorting method was utilized to evaluate the level of complexity of floor plans based on geometric shapes. O'Neill (1991) expanded upon Weisman's concept and examined the impact of floor plan complexity on wayfinding efficiency. In complex plans, the presence of circulation markings may diminish aimless wandering and enhance the efficiency of routing to a specific target (O'Neill, 1991). O'Neill also presented a method for assessing the complexity of a floor plan using ICD. This involves measuring the average number of circulations available for the wayfinder to choose at intersections. Additionally, O'Neill found that cognitive maps become less accurate as the average ICD increases, and the efficiency of finding the return route is reduced. However, the advantages of measuring complexity with this method help to reduce bias caused by the assessor in measuring the complexity of the floor plan. This method evaluates the physical characteristics of good site plans. Moreover, this method still has some limitations, specifically, it does not take into account the visibility of the target at intersections. This means that even if a floor plan is highly complex, if a person can still see the target, the complexity may not necessarily obstruct their ability to find a circulation. Conversely, if the target is not visible, decision-making at intersections could result in a mistaken direction and ultimately delay reaching the target. The purpose of this research is to investigate and experiment with the decision-making processes and behaviors that occur during Wayfinding Performance from one point to another. In order to evaluate the effectiveness of wayfinding performance, the researcher incorporated the model developed by O'Neill (1991) into the study. Consideration of the targeted visitors' search behavior entails focusing on observations of their outward actions during wayfinding. This method can be referred to as an evaluation of wayfinding performance based on external behavior, which includes analyzing the following aspects: 1) Walking rate. 2) Stopping and looking for a target. 3) Misdirection from the target point. 4) Retracing over the same path during the search. 5) Stopping at media and exhibit objects to find the target. 6) Walking back to see the media and objects on display. Therefore, this research aims to study the problem of wayfinding for museum visitors and explore factors such as floor plan management and perception of exhibit information that affect wayfinding efficiency performance.

Research Objectives

1. Compare the level of complexity of the floor plan and the circulation that influenced the efficiency of wayfinding within the history museum.

2. Propose guidelines for designing floor plans and circulations that influenced the efficiency of wayfinding within the history museum.

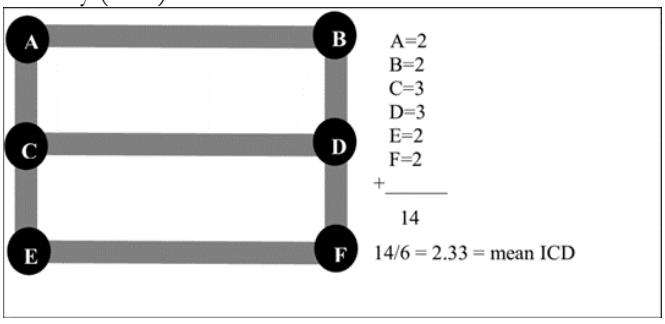
Research hypothesis

The level of complexity of floor plans and internal museum circulation (ICDs) significantly influences target acquisition performance within a history museum.

Literature Review

1. A study aims to assess the level of complexity of floor plans and circulation using ICD, which measures the average number of pathways that visitors can choose at different intersections. An increase in the average ICD is found to result in a decreased accuracy in cognitive map creation and a decrease in the efficiency of retracing the path. O'Neill, (1991) (Fig. 1)

Figure 1. Assess the level of complexity of floor plans and circulations by using Inter-Connection Density (ICD).

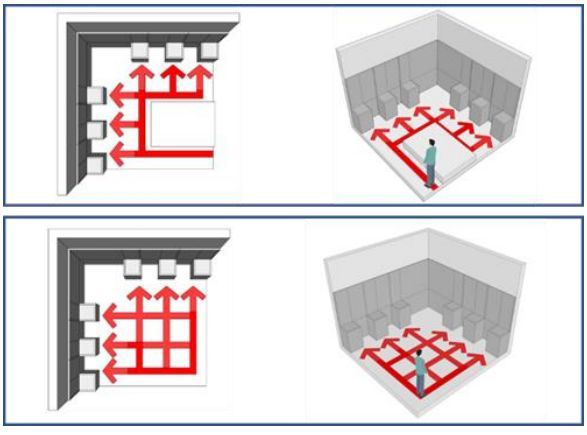


2. The study of floor plans and exhibition circulation (David A. Robillard 1982) can be divided into 2 forms:

Type 1) Control floor plan, which determines the entrance, exit, and the sequential path of traffic to ensure continuity.

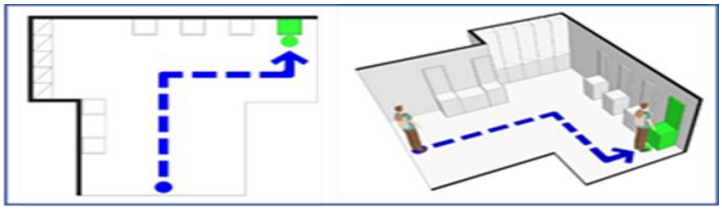
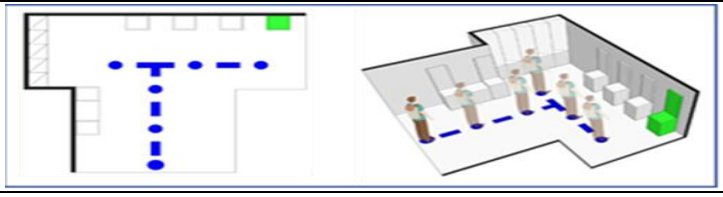
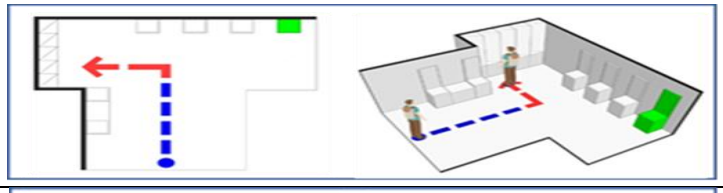
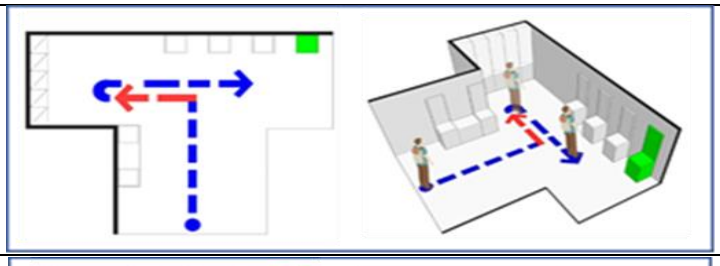
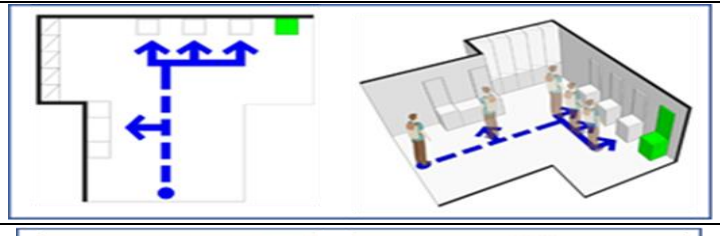
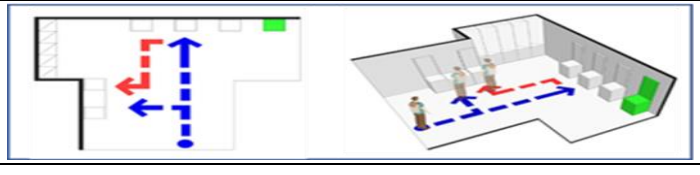
Type 2) Open floor plan, which allows museum visitors the freedom to choose their own path and explore the media and objects in the exhibit as they wish. (Figure 2.)

Figure 2. Layout of the floor plan and the exhibition circulations, the control floor plan and the open floor plan.



3. In the study of wayfinding performance, O'Neill (1991) proposed a model for determining the wayfinding behavior of building visitors. The model emphasizes the observation of external behaviors exhibited during the process of wayfinding and utilizes specific methods. This wayfinding performance is assessed by considering 6 behaviors., as presented in Table 1.

Table 1. Presents wayfinding efficiency of 6 behaviors.

Wayfiding Performance Description of all 6 Behaviors	Wayfinding Performance Illustration of all 6 Behaviors
1. The wayfinding walking behavior refers to a pattern where visitors of the permanent exhibition in the museum traverse different sections of the area without pausing at any specific point. This behavior is motivated by the visitors' intention to search for a specific target or objective while gathering diverse information along the way.	
2. The behavior of stopping and looking for a target refers to the permanent visitors at the exhibition within the museum coming to a halt during their journey. They pause and spend at least 3 seconds examining their surroundings, specifically searching for specific targets or points of interest.	
3. The behavior of misdirection from the target point refers to visitors of the permanent exhibition inside the museum turning in the opposite direction away from their intended target. In this behavior, visitors mistakenly choose an incorrect direction or circulation, deviating from their intended towards the target.	
4. The behavior of misdirection from the target point refers to visitors of the permanent exhibition inside the museum walking backwards over the same path that they have just traversed, when they realize they misdirection. This behavior occurs when visitors backtrack on the same path they have already taken in order to correct their course and find the correct circulation towards their intended destination.	
5. The behavior of visitors looking at the media objects of the exhibition refers to visitors of the permanent exhibition inside the museum walking up to a media object or display and coming to a complete stop. They pause for more than 5 seconds, dedicating their time to closely observe and interact with the object in order to accomplish their target or destination.	
6. The behavior of walking back to see the media and objects on display refers to visitors of the permanent exhibition inside the museum retracing over the same path to the media displays or exhibit objects they have previously visited.	

Research Methodology

The research objectives for investigating the reasons for choosing a research method are based on the process of searching for empirical knowledge. The focus is on studying the effects of one variable on another by setting a hypothesis, testing it, and finding the corresponding answer. This process is led by observing the behavior of visitors and implementing criteria to systematically measure variables that

have occurred. The researcher considers the research method selection criteria outlined by Creswell & Clark (2011) as quantitative research with clear data collection tools, involving the collection of numerical data and analysis using statistical processes. For this study, the researcher utilizes Experimental Research to examine the influence of floor plan complexity patterns on the wayfinding performance of visitors to permanent exhibitions within a museum.

Research Experimental Variables:

These research variables are derived from a hypothesis designed to test and find a solution. The variables are based on observations of visitor behavior and criteria to measure the influence of exhibition floor plans on target search behavior. They can be divided into two variables as follows:

Independent Variables

The complexity level and layout of the floor plan and circulation were divided into 4 categories:

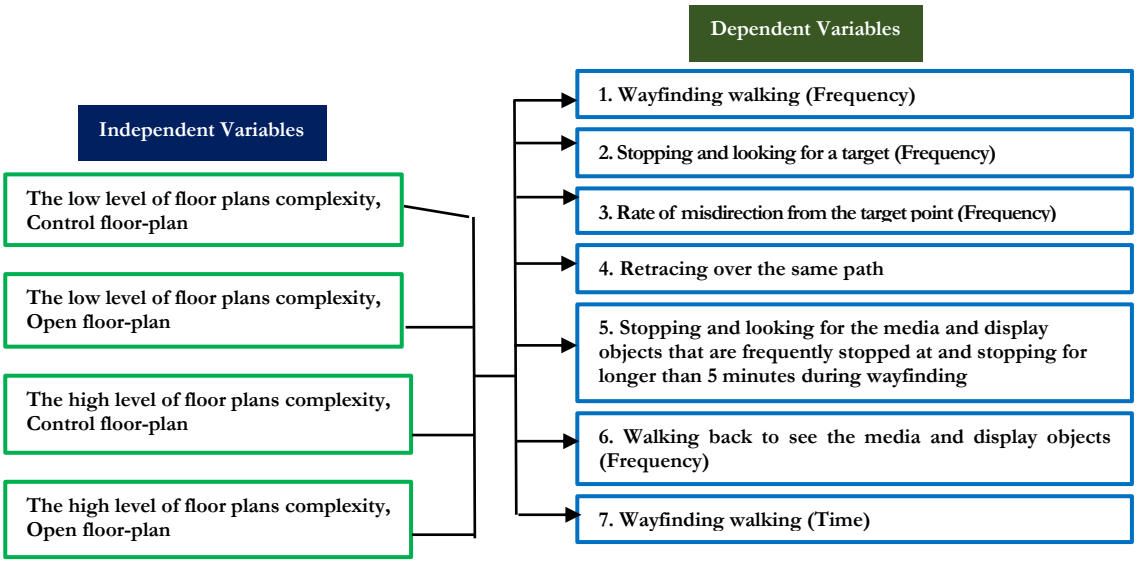
1) Floor plans and exhibition circulation with a low level of complexity and ICD value, control floor plan.
2) Floor plans and exhibition circulation with a low level of complexity and ICD value, open floor plans.
3) Floor plans and exhibition circulation with a high level of complexity and ICD value, control floor plan.
4) Floor plans and exhibition circulation with a high level of complexity and ICD value, open floor plan.

Dependent Variables

The wayfinding performance variables for all six target search behaviors are:

1) Wayfinding walking.
2) Stopping and looking for a target.
3) Misdirection from the target point.
4) Retracing the same path for the target.
5) Visiting to view media objects on display.?
6) Walking back to see the media and objects on display. (Figure 4.)

Figure 4. Conceptual framework for research variables.



Population and sample

Visitors in the exhibition are of various types, including groups visiting for entertainment purposes and groups that come to study and gather learning information (Bidgood, 2002). In this study, the researcher selected purposive sampling to target groups specifically interested in finding learning information, such as students from schools and universities. The aim of this research is to examine and test how the format of the exhibition floor plan influences the efficiency of targeted search for visitors. Therefore, the target group for the experiment was 200 second and third-year students. They were divided into 4 groups as follows:

Experimental Group 1) 50 participants who took part in the experiment with floor plans and exhibition circulation at a low level of complexity and ICD value, using control floor plans.

Experimental Group 2) 50 participants who entered the floor plan and exhibition circulation with a low level of complexity and ICD value, using open floor plans.

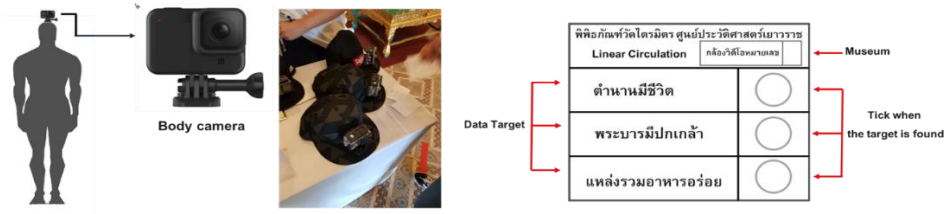
Experimental Group 3) 50 participants who took part in the experiment with floor plans and exhibition circulation at a high level of complexity and ICD value, using control floor plans.

Experimental Group 4) 50 participants who entered the floor plan and exhibition circulation with a high level of complexity and ICD value, using open floor plans.

Research tool

The researcher utilized a Body Camera (Body Cam) attached to the students to record their movement behaviors. This allowed for the assessment of wayfinding performance across all 6 behaviors. Additionally, the Body Cam was used to evaluate the participants' ability to find 3 designated search targets. (Figure 5.)

Figure 5. "Body Cam" attached to the student body and a questionnaire that finds the target.



Choosing an experimental site

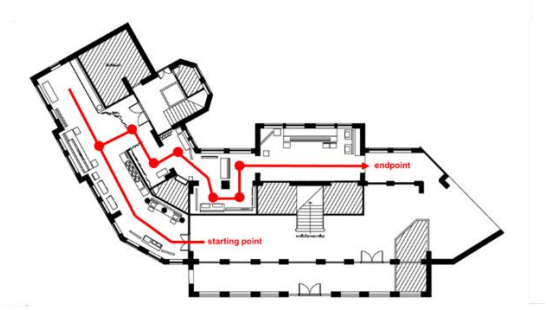
When considering the floor plan of a building, it generally consists of the usable area and traffic. In 1991, O'Neill came up with a way to assess the level of complexity of a floor plan using a design method. The objective that considers the ratio of possible routes to the number of choice points is the ICD.

It was found that when the ICD value is high, the efficiency of wayfinding for targets decreases. Therefore, this study used the ICD to determine the level of complexity of floor plans and circulation in relation to targeting performance within a history museum. The researcher conducted a preliminary survey in a museum building that exhibits history. There are 3 museums with 4 exhibition areas used to measure the level of complexity of the floor plan and circulation using the ICD value which are:

1) King Prajadhipok Museum Queen Rambhai Barni Exhibition, on the first floor, there is features floor plans and exhibition circulations with a low level of complexity and an ICD value of 2.14. Queen Rambhai Barni was the only consort of King Prajadhipok, also known as Rama VII. The layout of the floor and circulation determine the way in and out, as well as the order of the

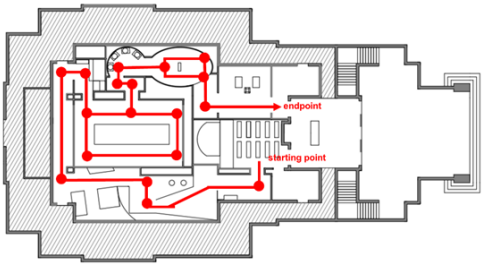
stories, creating continuity during the visit. (Figure 6.)

Figure 6. King Prajadhipok Museum Queen Rambhai Barni Exhibition.



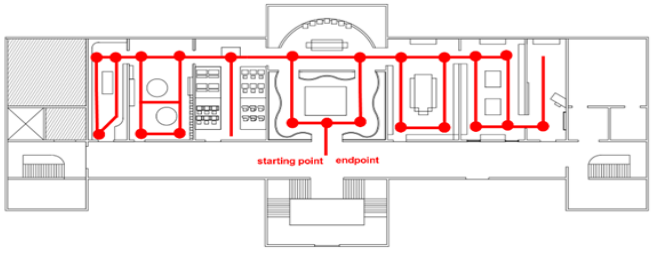
2). Wat Traimit Museum Yaowarat Historical Center is an exhibition about history of the Chinese community in an important area known as Golden Road, Yaowarat, Sampeng, the origin of the Chinese-Sampeng community and the arrival of overseas Chinese during the reign of King Rama I-III until it became the largest commercial area of Bangkok floor plans and exhibition circulations with high level of complexity and ICD value, control floor plan, ICD value = 2.22; Continuity. (Figure 7.)

Figure 7. Wat Traimit Museum, Yaowarat Historical Center.



3). Museum Siam an exhibition on history entitled "Decode Thai" presents the development of "Thai" from the past to the present. The layout of the floor plan and exhibition circulation with a low level of complexity and ICD value, open floor plan, ICD = 2.37 characteristics that allow museum visitors to be free to choose to view media and exhibit objects. (Figure 8.)

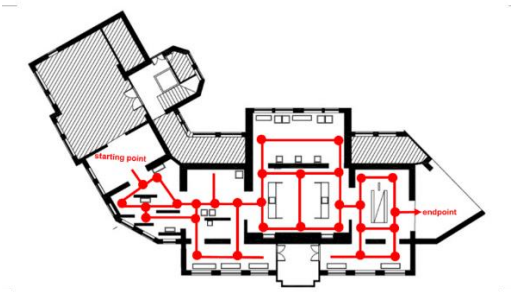
Figure 8. Museum Siam, an exhibition about history named "Decode Thai"



4). King Prajadhipok Museum Exhibition of the history of King Prajadhipok, exhibit the third floor. The exhibition displays stories about the royal history. royal duties, important royal duties in various fields. Exhibit models of Phra Phuttha Yod Fa Bridge and Pathom Borom Rachanusorn, floor plans and exhibition circulations with ICD complexity levels high, open floor plan, ICD = 2.46, a characteristic

that allows visitors to the museum to be free to choose to view media and objects on display, (Figure 9.)

Figure 9. King Prajadhipok Museum.



Experimental Procedure

The objective of the study was to compare the level of complexity of floor plans and circulations influencing the efficiency of target acquisition within the history museum. Experimental procedure in this experiment, traffic behavior was observed to determine the efficiency of the wayfinding performance for all 6 behaviors.

Step 1). In the experiment, each museum was 200 second-third year students divided into 4 groups: Experimental group 1: 50 people, entered the King Prajadhipok Museum, Queen Rambhai Barni Exhibition floor plans and exhibition circulations with a low level of complexity, ICD = 2.14, control floor plan. Experimental group 2: 50 people, entered the Museum, Siam Exhibition about the history of "Decoding Thai" floor plans and exhibition circulations with low complexity, ICD=2.37, open floor plans. Experimental group 3: 50 people participated in the experiment at Wat Traimit Museum Yaowarat Historical Center floor plans and exhibition circulations with high level of complexity, ICD=2.22, control floor plans. Experimental group 4: King Prajadhipok Museum Exhibition of the history of King Prajadhipok Trial on floor plans and exhibition circulations with high level of complexity, ICD=2.46, open floor plan. In the experiment, each museum was divided into 5 subjects to search for targets in the area at a time in each exhibition experiment. There will be a total of 40 sub-groups in Table 1. This is due to the need to reduce the congestion of the number of people and easy to observe behavior and reduce Social Effect Impacts, because if students see that friends can find where the target is, they will walk towards that point without using their own abilities. Based on these considerations, the number of people in the experiment was limited to reduce the chance of error. (Figure. 10.)

Figure 10. The experimental group went to the area in each museum.

Table 2. Presents the experimental of 4 experimental groups in each museum.

Experimental group 1. Floor plans and exhibition circulations with a high level of complexity, low ICD, control floor plans.					**Experimental group 2. Floor plan and exhibition circulations with low level of complexity, low ICD, open floor plan.**				
Group (N=50)					**Group (N=50)**				
Group1	Group 2	Group 3	Group 4	Group 5	Group 11	Group 12	Group 13	Group 14	Group15
5	5	5	5	5	5	5	5	5	5
Group 6	Group 7	Group 8	Group 9	Group 10	Group 16	Group 17	Group 18	Group 19	Group20
5	5	5	5	5	5	5	5	5	5
Experimental group 3. Floor plan and exhibition circulation with high level of complexity, high ICD, control floor plan.					**Experimental group 4. Floor plan and exhibition circulation with high level of complexity, high ICD, open floor plan.**				
Group (N=50)					**Group (N=50)**				
Group21	Group 22	Group23	Group 24	Group25	Group 31	Group 32	Group 33	Group 34	Group55
5	5	5	5	5	5	5	5	5	5
Group 26	Group 27	Group 28	Group 29	Group 30	Group 66	Group 37	Group 38	Group 39	Group40
5	5	5	6	6	5	5	5	5	5
Total (N=200)									

Step 2). The researcher had the research assistant attach a Body Cam to the students to record their movement behaviors and provided a problem sheet for finding a target with 3 search targets set. The students were informed that they were participating in a target search experiment within the exhibition. They were instructed to search for the target based on the 3 topics of the exhibition content problem set by the researcher. Students will be freely to walk regardless of any signs to reduce the problem of existing signs in the exhibition that can be a distracting variable. When the students had discovered the target, they were asked to walk and tell the research assistant who was responsible for the timer. However, students were forbidden to talk during the experiment when the target figure 11. was discovered.

Figure 11. Body Cam cameras installed on students for recording their movement behaviors and a problem sheet that finds a target with 3 search targets set.

Data Analysis

The objective of the study was to compare the level of complexity of floor plans and circulation influencing the efficiency of target acquisition within the history museum. In order to compare the difference in target search efficiency among the experimental subjects in the condition of different floor plans and exhibition circulations. When considering the variables in the research, it was found that, the independent variable has one variable, the level of complexity of the floor plan and the circulation has 4 models: 1). Floor plans and exhibition

circulation with a low level of complexity and ICD values, control floor plans. 2). Floor plan and exhibition circulation with low level of complexity and ICD value, open floor plan. 3). Floor plans and exhibition circulation with a high level of complexity and ICD value, control floor plans. 4). Floor plan and exhibition circulation with high level of complexity and ICD value, open floor plan. All 4 models have nominal measurement levels, or may be called discrete variables. Target search behaviors include: 1). Wayfinding walking. 2). Stopping and looking for a target. 3). Misdirection from the target point. 4). Retracing over the same path for target point. 5). Media and display object reviewing. 6). Behavior of walking back to to see the media and display objects. Each variable is measured as a ratio or a Continuous Variable because it counts the number of times each behavior actually occurs. Statistical analysis of Multivariate Analysis of Variance: MANOVA, was performed 6 times according to the number of available variables.

Results

Results of analyzing target wayfinding performance between different exhibition floor plan models, that all 4 models using Multivariate Analysis of Variance: MANOVA.

1. Behavior wayfinding walking, the results of the comparison analysis of Target's Wayfinding walking behavior with the level of complexity of floor plans and all 4 models are significantly different (df = 3, F = 1256.656, Sig = .000). Experimental group 1). Floor plan and exhibition models with low level of complexity and ICD, control floor plan (M = 31.34, SD = 3.12). Experimental group 2). Floor plan and exhibition circulation with low level of complexity and ICD value, open floor plan (M = 42.68, SD = 3.04). Experimental group 3). Floor plans and exhibition circulation with high level of complexity and ICD values, control floor plans (M = 39.30, SD = 2.19). Experimental group 4). Floor plan and exhibition circulation with high ICD and complexity, open floor plan (M = 54.49, SD = 2.79). as shown in Table 3.

Table 3. Presents the outcomes of analyzing variables related to target wayfinding walking behavior that influenced the complexity level of the floor plan.

Variable		$\bar{X}$	S.D.	F	Sig.
Dependent	**Independent**				
1. Behavior wayfinding walking.	Floor plans and exhibition circulation with low ICD values, control floor plans.	31.34	3.12	1256.656	.000
	Floor plans and exhibition circulations with low ICD values, open floor plans.	42.68	3.04		
	Floor plans and exhibition circulation with high ICD values, control floor plans.	39.30	2.19		
	Floor plans and exhibition circulations with high ICD values, open floor plans.	54.49	2.79		

*p < 0.05

2. Behavior of Stopping and looking for a target, Stop-and-look behavior comparison analysis results with the level of complexity of the layout of the floor plan and all 4 models were significantly different (df = 3, F = 215.729, Sig = .000). Experimental group 1). Floor plan and exhibition circulation with low level of complexity and ICD value, control floor plan, (M = 9.73, SD = 1.34).

Experimental group 2). Floor plan and exhibition circulation with low level of complexity and ICD value, open floor plan, (M = 12.80, SD = 1.38). Experimental group 3). Floor plans and exhibition circulation with high level of complexity and ICD values, control floor plan, (M = 14.48, SD = 2.19). Experimental group 4). Floor plan and exhibition circulation with high complexity and ICD, open floor plan, (M = 54.49, SD = 1.21). as shown in Table 4.

Table 4. Presents the findings from the analysis of variables related to the behavior of stopping and looking for targets that influenced the complexity level of the floor plan.

Variable		$\bar{X}$	S.D.	F	Sig.
Dependent	**Independent**				
2. Behavior of Stopping and looking for a target.	Floor plans and exhibition circulations that have low ICD value, control floor plan.	9.73	1.93	215.729	**.000**
	Floor plans and exhibition circulations with low ICD values, open floor plans.	12.80	1.34		
	Floor plans and exhibition circulation with high ICD values, control floor plans.	12.70	1.38		
	Floor plans and exhibition circulation with high ICD values, open floor plans.	14.48	1.21		

*p < 0.05

3. Behavior of misdirection from the target point, the analytical results of the comparison of misdirection from the target point behavior with the level of complexity of the layout of the floor plan and all 4 models were significantly different (df = 3, F = 376.952, Sig = .000).

Experimental group 1). Floor plan and exhibition circulation with low level of complexity, ICD, controlled floor plan, (M = 0.85, SD = 0.36).Experimental group 2). Floor plan and exhibition circulation with low level of complexity, ICD value, open floor plan, (M = 3.91, SD = 0.97).Experimental group 3). Floor plan and exhibition circulation with high level of complexity, ICD value, controlled floor plan, (M = 0.9, SD = 0.77).Experimental group 4). Floor plan and exhibition circulation with high level of complexity, high ICD, open floor plan, (M = 3.13, SD = 1.02). as shown in Table 5.

Table 5. Presents the results of the analysis of target's wayfinding performance that influenced the level of complexity of the floor plan.

Variable		$\bar{X}$	S.D.	F	Sig.
Dependent	Independent				
3. Behavior of misdirection from the target point.	Floor plans and exhibition circulations that have low ICD value, control floor plan.	0.85	0.36	376.952	**.000**
	Floor plans and exhibition circulations with low ICD values, open floor plans.	3.91	0.97		
	Floor plans and exhibition circulation with high ICD values, control floor plans.	0.9	0.77		
	Floor plans and exhibition circulations with high ICD values, open floor plans.	3.13	1.02		

*p < 0.05

4. Behavior retracing over the same path, the analytical results of the comparison of the behavior of walking backward over the same path and the level of complexity of the layout of the floor plan and the 4 models were significantly different (df = 3, F = 342.474, Sig = .000)Experimental group 1). Floor plan and exhibition circulation with low level of complexity and ICD, control floor plan, (M = 0.28, SD = 0.45).

Experimental group 2). Floor plan and exhibition circulation with low level of complexity and ICD value, open floor plan, (M = 2.81, SD = 0.95).Experimental group 3). Floor plan and exhibition circulation with high level of complexity and ICD value, control floor plan, (M = 0.38, SD = 0.55).

Experimental group 4). Floor plan and exhibition circulation with high complexity and ICD, open floor plan, (M = 2.53, SD = 0.89). as shown in. Table 6.

Table 6. Presents the findings from the behavioral analysis of the factors influenced the complexity level

of floor plans on the variables associated with retracing over the same path.

Variable		$\bar{X}$	S.D.	F	Sig.
Dependent	**Independent**				
4. Behavior retracing over the same path.	Floor plans and exhibition circulation with low ICD values, control floor plans.	0.28	0.45	342.474	**.000**
	Floor plans and exhibition circulations with low ICD values, open floor plans.	2.81	0.95		
	Floor plans and exhibition circulation with high ICD values, control floor plans.	0.38	0.55		
	Floor plans and exhibition circulations with high ICD values, open floor plans.	2.53	0.89		

*p < 0.05

5. Behavior of media and display object reviewing of the exhibition, the analysis results of the comparison of the behavior of viewing the media objects of the exhibit with the level of complexity of the arrangement of the floor plan and all 4 models are significantly different (df = 3, F = 879.724, Sig = .000)

Experimental group 1). Floor plan and exhibition circulation with low level of complexity and ICD value, control floor plan, (M = 19.90, SD = 1.70).Experimental group 2). Floor plan and exhibition circulation with low level of complexity and ICD value, open floor plan, (M = 21.10, SD = 2.12).Experimental group 3). Floor plans and exhibition circulations with high level of complexity and ICD values, control floor plan, (M = 25.20, SD = 1.43).Experimental group 4). Floor plan and exhibition circulations with high complexity and ICD, open floor plan, (M = 32.50, SD = 2.41).as shown in. Table 7.

Table 7. Presents the results of the behavioral analysis of the variables on walking backwards that affect the level of complexity of the floor plan.

Variable		$\bar{X}$	S.D.	F	Sig.
Dependent	**Independent**				
5. Behavior of media and display object reviewing.	Floor plans and exhibition circulation with low ICD values, control floor plans.	19.90	1.70	879.724	**.000**
	Floor plans and exhibition circulation with low ICD values, open floor plans.	21.10	2.12		
	Floor plans and exhibition circulation with high ICD values, control floor plans.	25.20	1.43		
	Floor plans and exhibition circulation with high ICD values, open floor plans.	32.50	2.41		

*p < 0.05

6. Behavior walking back to see the media and display objects, the results of the comparative analysis of the behavior of walking back to see the media and display exhibition objects with the complexity level of the floor plan and all 4 models were significantly different (df = 3, F = 209.573, Sig = .000

Experimental group 1). Floor plan and exhibition circulation with low level of complexity and ICD value, control floor plan, (M = 2.25, SD = 2.74).Experimental group 2). Floor plan and exhibition circulations with low level of complexity and ICD value, open floor plan, (M = 13.30, SD = 3.82).Experimental group 3). Floor plans and exhibition circulations with high level of complexity and ICD values, control floor plan, (M = 6.90, SD = 5.39).Experimental group 4). Floor plan and exhibition circulation with high level of complexity and ICD, open floor plan, (M = 13.60, SD = 2.85). as shown in. Table 8.

Table 8. Presents the analysis results of the behavioral variables on walking backwards that influenced

the level of complexity of the floor plan.

Variable		$\bar{X}$	S.D.	F	Sig.
Dependent	**Independent**				
6. Behavior walking back to see the media and display objects.	Floor plans and exhibition circulation with low ICD values, control floor plans.	2.25	2.74	209.573	.000
	Floor plans and exhibition circulation with low ICD values, open floor plans.	13.30	3.82		
	Floor plans and exhibition circulation with high ICD values, control floor plans.	6.90	5.39		
	Floor plans and exhibition circulation with high ICD values, open floor plans.	13.60	2.85		

*$p < 0.05$

The results of the experiment concluded that

1. Behavior wayfinding walking. The analysis results.Low circulation control floor plan has better target search behavior than floor plan and exhibition circulation with a high level of complexity and ICD, open floor plan. Due to exhibition visitors, floor plans, and exhibition circulations with a high level of sophistication and ICD values, control floor plans have fewer options because they are forced to move from one position to another. In the size of visitors, visitors to the exhibition floor plan and exhibition circulation with a high level of complexity and ICD value, open floor plan, the circulation's intersection, therefore, choose to walk around to find the target

2. Behavior of Stopping and looking for a target. The analysis results showed that the floor plan and the exhibition circulation had a low level of complexity and ICD value, and the control floor plan had better stop-and-go behavior than the floor plan and exhibition circulation with high level of complexity and ICD, open floor plan. Due to the clear vision of the target ahead, it was not wasted time to stop and look. In the visitor size, floor plan, and exhibition circulation with high level of complexity and ICD value, an open floor plan has to stop looking for targets often to determine the circulation.

3. Behavior of misdirection from the target point. The analysis results showed that, floor plan and exhibition circulation with low level of complexity and ICD value, controlled floor plan, had less chance of misdirection from the target point. In the size of visitors, the floor plan and the exhibition circulation have a high level of complexity and ICD value, open floor plan. There are more circulation options, making it more likely to misdirection from the target.

4. Behavior retracing over the same path. The analysis results showed that, the complexity level of the floor plan and the exhibition circulation, the low ICD, control floor plan had the behavior that the visitors wanted to find the target as soon as possible. Visitors choose to walk forward rather than walking back over the same path. In the size of visitors, exhibitors, floor layouts, and exhibition circulation with a high level of complexity and ICD values, open floor plans provide more path options, allowing for the opportunity to walk back over the same path to find the destination more often than

5. Behavior of media and display object reviewing. The results of the analysis showed that the floor plan and the exhibition circulations had a low level of complexity and ICD value, control floor plan. The behavior of viewing the media objects is less than floor plan and exhibition circulation with high level of complexity and ICD, open floor plan. Due to the opportunity to see the media objects on display is less, because it's cheap. Control floor plans can walk to see the media objects in the exhibition without having to look up closely, because of the distance of the walk not as wide as the open floor plan.

6. Behavior walking back to see the media and display objects. The results of the analysis revealed that, floor

plans and exhibition circulations with low level of complexity and ICD, control floor plans had less walking back behaviors to see the media and exhibition objects than those with floor plans and exhibition circulation of high level complexity and ICD value, open floor plan. Due to the layout of the open exhibition floor, the exhibition floor is arranged to create a circulation that allows museum visitors to be freely choose to view the media and objects in the exhibition. Resulting in the opportunity to walk back to see the media and exhibit objects again from the previous view is higher than the control floor plan.

Discussion and Conclusion

From the research objective 1). Comparison of the complexity level about floor plans and circulations on wayfinding performance within a history museum.O' Neill's 1991 assessment of wayfinding performance suggests floor plans and exhibition circulations with a low level of ICD-controlled complexity, can help exhibitions visitors within the museum to heading their destination easier. Because when visitors targeting to the exhibition, there will be forced to walk in a certain direction, reduce wayfinding walking period, a clear vision of the target ahead, don't waste a time to stop watching. With a low ICD level of complexity in a routing mode, walking inside the exhibition gives visitors the chance to walk less erratically from their targets. Visitors choose to walk forward rather than retracing over the same path. Control floor plans makes it easy reviewing the media objects of the exhibition, in the size of the floor plan and the exhibition circulation with a high level of complexity, high ICD value, open floor plan, causing the visitors of the exhibitions within the museum to search for more targets, because they have to view all exhibition areas, choosing to walk and reach the target including, having to look at the media and objects in the exhibition to make sure that they aims to the right target, and it's easy to misdirection because of the large number of options and have a high freely to walk, this is resulting in a lot of time spent on targeting. Therefore, the research results show that, floor plans and exhibition circulations with a low level of complexity, low ICD, floor plan control have better wayfinding efficiency than the plans. Exhibition floor and circulations with high level of complexity, ICD value, open floor plan. In the following research, the researcher proposed testing with other types of museums, such as the Museum of Science and technology exhibits vernacular museum natural history museum, to test whether different exhibit contents affect target search performance.

From the research objective 2). Propose the design guidelines for floor plans and circulations that affect the efficiency of targeting within the history museum. The results of the research can be used to design floor plans and circulations within the museum to find targets quickly. The layout of the floor and exhibition circulations with a low level of complexity, low ICD control floor plans, allows the museum visitors to find their targets efficiently. Because there is no time wasted in target's wayfinding and its direction, because there are fewer alternative points. But there may be problems with walking that may take time to walk through unnecessary places instead of going straight to the target immediately. Moreover, the research also offers new perspectives on the design of floor plans and exhibition circulations, which supports the need to quickly get museum visitors from one point to another. If designers understand this point, they can design a floor plan and a circulations that directs towards the main point of the exhibition. While wanting museum visitors to be able to walk freely, they choose floor plan and exhibition circulation with high level of complexity, open ICD. It may not be appropriate for museum visitors looking to find a specific target. Because the floor plan is complex, the ICD value is high, open floor plan, increasing a large number of choices may lead to hesitation leading to lost but the advantage of an open, high-ICD complex floor plan is that, the museum's visitors are highly involved in the space. Because have to stop to look at the media and objects on display together with the activities organized by the exhibition. It can make visitors get more information about the exhibits and participate more. Therefore, the use of the research results in the design should take into account the purpose of

the design in order to make the layout of the floor and circulations suitable for the content of exhibiting activities and behaviors of visitors within the museum. Including a comparison test of the real environment and the virtual environment to see how it affects the efficiency of finding targets in order to further develop the design of the virtual museum.

Suggestion

This research procedures are experimental research that minimizes the shortcomings of experimental research with caution in terms of environmental accuracy. These data are collected from visitors to the exhibitions within the museum who directly access the space. Improved fidelity to reality than conventional research that is often done in a laboratory. However, this research is also having some limitations, start with the problem of variables to be studied namely; the level of complexity of the floor plan and exhibition corridor ICD is an important factor in the study of target acquisition. But past research has suggested that several factors should be considered simultaneously, such as, target visibility symbol and area differences which is difficult to study in real space. The main reason why the researcher chooses to study only one factor is because of the opportunity to collect data and modify different areas. In the museum it is difficult to comply with the experiment. It is easier to choose to study 4 museums that are clearly different in terms of floor plans and exhibition circulations with a level of complexity, ICD values. If choosing to study additional variables such as, one additional target vision level may cause problems in managing the area in accordance with the additional variables and mees the experimental conditions. The results of the research are conclusions derived from the comparison of floor plans and exhibition circulations with 4 levels of ICD complexity. There are other types of floor plans and exhibition circulations that have not been evaluated. For example, a comparison of different types of traffic, only one or multiple entrances. Spatial organization and circulation design, including multi-level corridors also visibility level factors symbols or differences of the area to join the research, to make the research more complete. Moreover, the selection of the experimental group with the sample as regular or infrequent visitors to the exhibition that come to see what kind of floor plans or physical environment design, keeps visitors coming back for more or other public building traffic experiments such as, hospitals, schools, department stores or experimenting with computer-simulated virtual environments, such as, using VR (Virtual Reality), AR (Augmented Reality), MR (Mixed Reality), which, if successful, could make a big difference in design research.

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