A Practical Step towards Integrating Elderly Pathway Design into Museum Space Planning: Framework of Satisfaction Assessment

Raed M. A. Elottol [a*] **and Azizi Bahauddin** [a]

[a] *School of Housing, Building and Planning, Universiti Sains Malaysia, MALAYSIA*
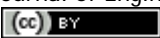
A R T I C L E I N F O	A B S T R A C T
	The study examines how elderly visitors' perception, interior environment, pathway design quality, and satisfaction are related in the context of interior environment and space planning of museums. This paper explores a theoretical as well as practical key issue in elderly pathway design in museums in Malaysia. The research intends to explore the elderly pathway design that interacts with the interior environment and space planning in museums. This is to fully understand the relationship between elderly visitors' satisfaction and pathway design. This paper plans to answer critical questions; what is interior pathway design? How does the pathway design relate to the elderly visitors' satisfaction? And what is the relationship between elderly visitors' satisfaction, and pathway design quality? This study is one of the few studies focus on elderly people and pathway design. The empirical analysis carried out on 509 of elderly visitors in 21 museums in Malaysia allows us to confirm that the quality of interior pathway design is a direct determinant of elderly satisfaction. The results also reveal that there is a significant relationship between elderly satisfaction and quality perception. Finally, the interior environment elements of museums such as lighting design, furniture arrangement and finishes materials are also considered.

1. Introduction

This study concerns about the pathway design of the museums and the elderly visitors'

satisfaction in Malaysia, and to assess the adequacy of the circulation design of the museums, the study uses the confirmation and disconfirmation process as a reference point to investigate the overall satisfaction of the elderly visitors. Wener (2002) discusses the issues of circulation, orientation and pathway design. According to him, there is growing evidence that the interior designers of museums are either unconcerned or largely ignorant of the needs of users and visitors. He considers pathway design in museums and orientation as the first, and possibly the most basic behavioral need of visitors upon entering the museum. Wener also highlights the nature of visitors in the museum and the questions of place orientation and pathway, such as "where am I?" and "how do I get from here to there?" as well as the function of pathway and circulation, such as "how does this pathway system work?". Elderly visitors in museum will try to answer all these questions efficiently and fast to enjoy the visit and to spend the rest of the time focusing on the objects in the museum (Weissmann. and Islam. 1996). Richard (2002) states that if the pathway in buildings are insufficiently designed, the remaining options for user will be asking others for help, observing the actions of others or spending much time just to find the direction. He considers each option as a source of capriciousness and therefore stressful in and of itself which may lead to dissatisfaction. The remaining option for visitors is self-exploration, which can be even more frustrating (Wener, Richard et al. 1982; Wener 2002). Weisman (1983) also finds in his study that experts' ratings of the complexity of floor plans correlated highly with the likelihood of space users getting lost (Weisman 1983). Reussner (2004) finds that, from the late 1980s, continuous criticism regarding to the lack of studies and audience research for museums, as well as the lack of proper guidelines can consider all genders and ages of visitors (Reussner 2004).

Until now there are no researches have been conducted to measure the attendance of elderly people in museums, but some studies (Bitgood 1991; Weissmann. and Islam. 1996; Rogers 1998; Tufts and Milne 1999; Rojas and Camarero 2008; Webb 2010) give indications that elderly visitors are very interested in visiting museums. Based on Roger's research (1998) most of the museums visitors in his study are ranged from age 50 -70 (elderly), and as a result of his study also, elderly visitors of museum have a high expectations concerning museums' interior design and comfort level in terms of interior pathway and circulation system. Roger explains that elderly attendance could be based on (a) personal characteristics such as nostalgia, (b) experiences, and (c) general levels of satisfaction with the museum itself and interior design. In different study Rojas and Camarero (2008) also state that in order to use museum resources

Raed M. A. Elottol and Azizi Bahauddin

and design in the most successful and advantageous manner, museums need more studies to identify what factors have to be considered for the visitors' circulation and pathway in museums (Rogers 1998; Rojas and Camarero 2008). Throughout museums' basics, museum design must emphasis the relationship between visitors and space. In Malaysia, the absence of interior pathway design's strategy for elderly visitors is noticeable, where at the museums in Malaysia it is easy to get tired and old people may tire particularly quickly (Researcher 2009). To achieve efficient interior circulation and pathway design of museums for elderly people, designers must understand the nature of elderly visitors, behaviour, design data and their needs.

According to several studies (Wener 1998; Wavell, Baxter et al. 2002; Yin 2003) many of the elderly visitors have impaired mobility, and some of them are in wheelchairs, but more simply walk slowly and painfully. Some also use a stick or simply find stairs very difficult. In order to overcome this problem, Malaysian government endorsed the Biwako Millennium Framework for Action (BMF) in the year 2002. It announced the extension of the Asian and Pacific Decade of Disabled and Elderly Persons (Meng 2009). Accessibility to built environment and pathway design are some of the areas out of 7 priorities in the policy which Biwako Millennium Framework for Action would like to achieve. The policy reflects the consequence of implementing a barrier-free in order to accommodate the involvement of disabled people and elderly in the society (Meng 2009). Thus Meng (2009) also states in his study that, "The design strategy for pathway design and accessibility for elderly and disabled in museums' buildings in Malaysia needs to be ascertained" (Meng 2009). Mohamed and Mustafa (2005) in their study also find that, designers are still unfamiliar with the needs of the elderly people which are of great importance. They state that, In Malaysia, until now there is no source or study which can give a great source of information related to the elderly user's needs, capabilities, and interior pathway design. However holding these sessions may be a challenge for several reasons. These challenges involve adjusting for diversity of the older population and their physical and cognitive differences, dealing with the attention characteristics of this population (Black 2005; Black 2008).

Finally, several studies (Ching 2004; Department of Statistics in Malaysia 2009; Cusiima 2010; Department of Finance and Personnel 2010) highlight that understanding of museum space planning and form of pathway is a very important factor affects the visitors' circulation and satisfaction with museums. So, it is believed that the desired outcomes of this study should assist designers to consider better ways for museum space planning and pathway design by

making them aware about the true level of elderly satisfaction with museums' design in Malaysia.

2. Interior Pathway and Circulation Design

Bitgood (1988) highlights the importance of pathway design in museums. He states that, the museums' interior design and the layout of the exhibitions in the building that constrain visitor circulation may determine visitors' methods of interaction with display objects (Bitgood 1994; Bitgood 2005; Bitgood 2010; Bitgood 2010). Therefore, the way in which pathway is designed is the major question of museums' interior design. Nowadays, It becomes a fact that the interior pathway is the key issue for exhibition and museums' design (Hall, Basarin et al. 2010; Haywood and Cairns 2010; Heath and Lehn 2010; Hendon 2010; Holjevac, Marković et al. 2010; Holl's 2010). At the same time designers must understand that all elements of circulation and pathway are important, so in museum design process, pathway is the main key of decisions regarding how the collection will be displayed and viewed for visitors. On the whole, pathway design becomes critical for moving the museum's visitors through the building (The International Council of Museums 2009). Several studies state that interior design of museums must meet the specific needs of elderly or disable visitors, such as accessibility, pathway design quality, space planning, comfort level and visitors' satisfaction (Foster 2010; Goodman, Gallant et al. 2010; Goor-balk, Warmerdam et al. 2010; Hall, Basarin et al. 2010; Haywood and Cairns 2010; John J. Koran, Jr. et al. 2010). So to design a museum properly the interior pathway must be considered and involves the creation of solutions of all problems. Therefore, elderly movement in space/time also to be resolved in the ultimate sustainable plan (Yalowitz 2002; Yenawine 2002; Wunsch, Jones et al. 2010; Hsu 2004). Moreover, Hsu (2004) and others highlight a very important issue that visitors may not be mindful of how their bodies and movement are in continuous dialogue with the pathway and interior environment. In different meaning, how visitors practice the three dimensionality of a building (perceptual function) is mainly through movement of our bodies through time, sequence and space (Zelanski and Fisher 2010; Zorloni and Wien 2010; Hsu 2004). Few researchers only wrote about the pathway and the interior circulation within buildings. Beirne (2003) stresses that the horizontal circulation and pathway can be considered as, "all walking areas on all floors of a building required for physical access to some spaces". This is including to the horizontal features such as corridors, lobbies, verandas, porches, doors, entrance foyers, and balconies. He also defines vertical circulation as; "all walking areas and mechanical tools installed in all

Raed M. A. Elottol and Azizi Bahauddin

floors of a building required for vertical physical access to some space" This is also including to staircases, ramps, elevators and escalators (Beirne 2003). Moreover, G. Black (2005) in his research defines interior circulation in buildings as:

"The all walking areas on all floors of a building required for physical access to some subdivision of space, whether physically bounded by partitions or not. Included Horizontal and Vertical circulation, which should be but is not limited to, public corridors, exhibition spaces, entrance foyers, elevator lobbies, tunnels, bridges, and each floor's footprint of elevator shafts, escalators and stairways. Also included are corridors, whether walled or not, provided they are within the outside facelines of the buildings to the extent of the roof drop line." (G. Black, 2005: 12).

Finally, Stephen (2009) explains clearly the interior circulation in the buildings as;

"A term describes how visitors make their way through the facility. What pathways do they take? Do visitors circulate the way the designers intended? Do visitors miss key exhibits because of the architectural design of the facility? Which direction do visitors turn when they reach choice points? Do visitors have a circulation strategy (e.g., "Turn right and follow the perimeter") or do they simply wander more or less aimlessly?" (Stephen, 2009: 44).

Ching (2004) discusses in detail the configuration of pathway design , he states that:

"All paths of movement, whether of people or services are linear in nature. And all paths have a starting point, from which we are taken through a sequence of spaces to our destination. The contour of path depends on our made of transportation. While we, as pedestrians, can turn, pause, stop, and rest at will" (Ching, 2004:134).

In addition, Ching (2004) discusses the nature of a path's configuration influences, the factors affect path's configuration. Ching thinks that the most important factor affects pathway configuration is the visitors' orientation within the building. According to Ching, there are many types of circulation paths in buildings, Ching also lists down the most popular types such as: Linear Circulation Path, Radial Circulation Path, Spiral Circulation Path, Grid Circulation Path, Network Circulation Path and Composite Circulation Path (Ching 2004).

3. Elements of Interior Pathway Design and Circulations

The efficiency of interior pathway and circulation system in museums determined by the basic shape and form of building. Buildings of the same internal floor area and same function differ in the proportion of space taken by elements of interior circulation and pathway. It differs also in the design style of circulation and pathway elements such as lifts, corridors and other mechanical equipment (Sookhanaphibarn and Thawonmas 2009.; Bitgood 2010; Bitgood 2010; Bitgood 2010; Bolton 2010). The time needed by a visitor to move from one area within the

*Corresponding author (Raed M. A. Elottol). Tel/Fax: +60174405868 . E-mail addresses: aaraed@yahoo.com.

building to another area and the enjoyment of doing this by visitors are affected by the building form, pathway design and circulation style that is designed (Khan and Syed 2009; Martı´n-Ruiz, Castellanos-Verdugo et al. 2009; Mattsson 2009; Meng 2009; Rohloff, Psarra et al. 2009). The design of interior circulation elements such as stairs, corridors and mechanical circulation elements are very important issue for interior designers. In addition, the design quality of a building depends at first on the basic analysis of the traffic flow of visitors or users and the follow-on decisions on the primary form of the building (Canada Science and Technology Museum Corporation 2009; Carney 2009; Department of Statistics in Malaysia 2009; Foster, Koran et al. 2009; Guidlines 2009). In general, the elements of interior circulation and pathway at a building such as lifts and escalators, stairs and corridors differ in visitors' carrying capacity and design requirements. Moreover, the interior designers must consider and match the characteristics of each element with those of the traffic generated in buildings (Roberts, McKay et al. 2008; Rojas and Camarero 2008; Satoh 2008; Taha 2008; Tran 2008). For example, the main entrance area in buildings is considered small but it is carrying a major quantity of traffic, as become principal nodes of the pathway and circulation design, with the optimum shape of the building dependent on the ratio between internal traffic and movement to and from the outside (Abaci and Kamaraj 2009; Board of Directors of the Hawaii Public Housing Authority 2009; British Standard 2009; Brititsh Standard 2009; Burns and Bowling 2009).

4. Aspects of Interior Pathway and Circulation Design

Kaynar (2010) points out that, the designer must meets the pathway and circulation function in buildings, and the architectural design should embrace appropriate space to house and to improve traffic from area to area. Aspects of interior pathway determine the criteria for the success of the design and evaluation criteria. According to Hsu (2004) this includes at least five aspects: approach, entrance, configuration of the path, path/space relationship and form of the circulation space. By using any museum as example, one can appreciate the relevance of each following component of pathway and circulation (Amburg 2007; Banning and Schoen 2007; Brock 2007; Butterworth 2007; Rojas and Camarero 2007).

4.1 Approach

The axial general view of the interior design and entrance lobby form the approach of the interior circulation and pathway design in museums' spaces. Based on the study of Kaynar

Raed M. A. Elottol and Azizi Bahauddin

(2010) the distant view before entering the building is very important to prepare the visitors for the experience of the spaces in the museums (Kaynar 2010; Hsu 2004).

4.2 Entrance

The entrance of a museum is the start point where the visitors move from the outside space to the interior space. Kaynar (2010) points out that Museum's entrances are usually highlighted by very visible items or attractive patterns, decorative or structural components. Finally, in modern museums, great effects linked with the entrance design have served as a preview of what the visitor can expect, which increase the expectation levels of visitors (Code 2003; Communities 2003; Community Council of Devon 2006; Kaynar 2010).

4.3 Pathway Configuration

Based on study of Kaynar (2010), he finds that pathway configuration is a term refers to the path of movement from a starting point to the end point within the museum. In any building, the configuration of the path is strong-minded by some conditions, such as the overall shape of building, the form of the pathway, the volume of space selected to the path and organizational pattern of the spaces it links. However, researchers (Pearlmutter, Berliner et al. 2006; Rounds 2006; Sakkas and Pe´rez 2006; Sharma and Dhariya 2006; Sheeks 2006) consider all paths as linear, and the configuration or shape can take on other forms.

4.4 Path/Space Relationship

According to several studies (Bitgood 1992; Bitgood 1999; Ching 2004; Black 2005; Canadian Museums Association 2006; Community Council of Devon 2006; Foster 2010; John J. Koran, Jr. et al. 2010) the relationship between the path and space in a museum can be linked in three different ways. First, the path passes by the exhibitions and spaces, ensuring the connectivity for each space. Second the path passes through spaces. In turn, the intervening of spaces trespassed creates patterns of rest and movement. Third, the path terminates in a space, often as a way of emphasizing the importance of the final destination. Kavangah (1991), in his research highlights the importance of locations of facilities, and according to him, it is the time now to consider the location of facilities in museums.

4.5 Form of the Circulation Space

Form of the circulation, is how the pathways for movement are integrated into the spatial organization of a building. So the form and size of the circulation space must to be considered in museums. A circulation space may be enclosed, open on one side or open on both sides (Han

and Cho 2006; J.A.Renshaw 2006; Jeong and Lee 2006; Jun, Kyle et al. 2006; Khattar 2006). It also can be narrowed to encourage forward motion or widened to create spaces for waiting or stopping. The form of the circulation space can be adjusted to distinguish the rote of the pathway as either for visitors or service corridor (Community Council of Devon 2006; Crayford 2006; Dalke, Little et al. 2006; Davey 2006; Gutwill 2006). Ching (1979) discusses in detail the configuration of path and the form of circulation space. According to him the form of pathway depends on our design of transportation and building form. Several studies (Ching 2004; Department of Statistics in Malaysia 2009; Cusiima 2010; Department of Finance and Personnel 2010) highlight that understanding of museum space planning and form of pathway is a very important factor which affects the visitors' circulation and satisfaction with museums.

5. Elderly People and Satisfaction

The definition of 'elderly' has differed among institutions and researchers. According to Mat and Taha study (2003) The United Nations World Assembly On Ageing held in Vienna, 1982, used '60 years and over' as the cut-off in deliberating ageing trends (Mat and Taha 2003). Immediately, Malaysian policy makers have adopted this demarcation and are officially used in planning for senior citizens. This research has thus used the same age cut-off to refer to senior citizens in Malaysia (Mat and Taha 2003; Wong, Rajikan et al. 2010). Recently, the populations are growing older more and more in all countries all over the world. According to Kinsella & Phillips (2005) by 2030, almost 1.2 billion of the expected 1.5 billion people age 65 or older will inhabit in less developed regions and more will be in developed countries. The ratio of aging 65-80 or older will reach to 14.3% while in Europe the ration will be 30% of all populations which is very high.   Therefore, just 22 % of the world's older citizens will live in developed countries (Kinsella and Phillips 2005). This demographic change will extremely affect the health services, socioeconomic development, design requirements and sustainability of all nations. The reason for that is the population aging may be seen as a human success story of the country and a strong indication toward the strength of the level of public health, medical advancements, and economic development over diseases. But the common phenomenon of aging also brought an acknowledgement by the United Nations (UN) of the many challenges such as, aging and design criteria, general development, issues concerning the sustainability and the ability of states and communities to consider   aging populations and to consider their satisfaction (Kinsella and Phillips 2005).   Figures 1 and 2 show population age-sex structure in developed and less developed countries.   A review of the population for the past four censuses

Raed M. A. Elottol and Azizi Bahauddin

find a visible decreasing proportion of population in the younger ages and a sharp increase in the older age groups (Kinsella and Phillips 2005).
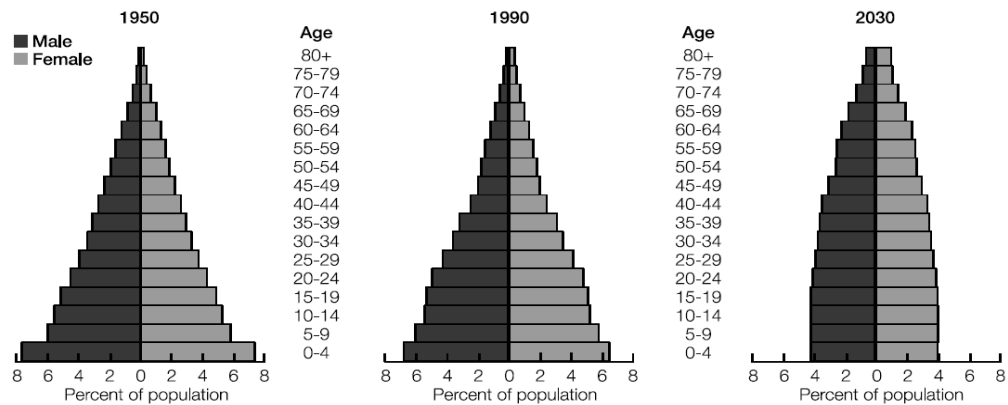

Figure 1: Population age-sex structure in less developed countries, 1950, 1990, and 2030 (Kinsella and Phillips 2005).
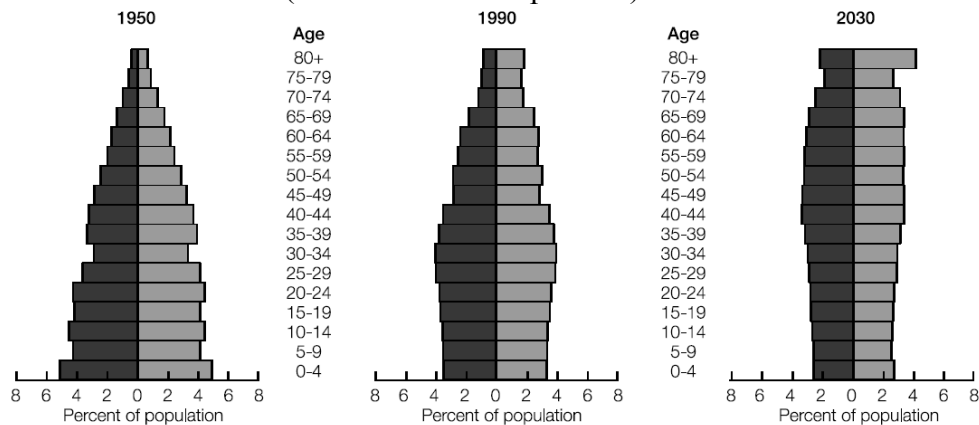

Figure 2: Population age-sex structure in more developed countries, 1950, 1990, and 2030. (Kinsella and Phillips 2005).

It becomes a fact that the elderly people in Malaysia are increasing at a faster rate than the total population growth and will more than double in numbers from the current 1.4 million to 5 million or more in 2030 (Mat and Taha 2003). Malaysia is considered as a fast developing nation (Mat and Taha 2003), so recording the needs of elderly people is a crucial to balanced the growth of the nation and to consider past, present and future trends of the elderly people in Malaysia. According to Mat and Taha (2003) this is the time to create awareness of the space planning and implementation of interior design for the elderly population in Malaysia (Mat and Taha 2003). However, until now there are no studies measuring the level of elderly attendance at museums in Malaysia. Researchers in Malaysia don't know if elderly people are interested to visit museums or not. Internationally, several studies (Gotlieb and Brown 1994; Korn 1994; Parasuraman, Berry et al. 1994; Ritchie 1994; Katz 1994,) show that, elderly people are very interested in visiting museums. In a study for a botanical garden museum, Hood and Roberts

(1994) find that the group with the largest attendance was aged 55 and older. This group is considered for one-third to one-half of the visitors on any given day. Studies find also that elderly visitors were more interested in purchasing in the souvenir shops in museums (Gotlieb and Brown 1994; Korn 1994; Parasuraman, Berry et al. 1994; Ritchie 1994; Katz 1994,).

6. Research Hypotheses

According to Gronroos (2000) design quality can be defined from two perspectives. They are technical quality (what is delivered to the visitors) and the functional service quality (how it is delivered) (Rojas and Camarero 2007; Pile 2010). In another study, Brady and Cronin (2001) figure out that the design quality can be outlined by three perspectives. They are outcome quality, interaction quality, and physical environment quality in buildings. As the environment quality refers to the ambient conditions(Rojas and Camarero 2007). Oliver (1997) states that visitors' interpretation is related to the level of expectations. According to (Rojas and Camarero 2007) expectations is known as previous predictions or beliefs of visitors before they enter the building. According to Oliver (1997), the quality of design is based on perceptions of excellence. Oliver (1997) also states that it is logical to believe that perceived quality is influenced by the expectations of the visitors (Rojas and Camarero 2007). It becomes a fact that visitors use their expectations to evaluate design quality and performance. Therefore, researchers propose the first hypothesis:

(H1. Visitors' expectations positively influence visitors' perception of interior pathway design quality and interior environment of museums.)

Recently, design quality is believed to be the right judgment exposed by visitors who estimating the quality level of design. So, satisfaction and design quality are highly interrelated (Rojas and Camarero 2007). Researchers accept the theory said that quality leads to satisfaction. On this basis, we propose the second hypothesis:

(H2. Interior Pathway design and space planning of museums positively influence the elderly visitors' satisfaction.)

Disconfirmation happens when interior pathway design quality is lower or higher than what visitors expected after they made the final decisions (Oliver 1996). If the interior designs higher or lower that the visitors' expectations, a positive or negative disconfirmation occurs and this will increase or decrease the level of satisfaction. According to Oliver (1996):

Raed M. A. Elottol and Azizi Bahauddin

"Consumer satisfaction is a function of expectations and disconfirmation, and prior expectations are used as the comparable standard. Past empirical research has shown that expectations have a significant effect on disconfirmation"(Oliver 1996; Rojas and Camarero 2007).

7. Methodology

In order to test the proposed hypotheses, the empirical study performed is based on information collected by means of a questionnaire presented to visitors of 21 selected museums. The 21 Museums are located in Kuala Lumpur, Terengganu, Selangor and Kedah in Malaysia. The museums have been selected based on the following criteria: (a) State history theme, (b) Geographic location, (c) Annual attendance, and (d) Quality of interior design & environment. After proceeding to the quantitative study of 21 museums, interviews and observations (qualitative study) conducted for four selected museums. The four museums have been selected based on the following criteria; the importance and the value of the museum, number of visitors per year, style of design, and location of museum (Figure 1).
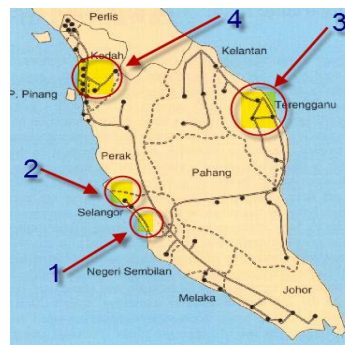

Figure 1: Locations of selected museums in Malaysia.

Interviews with the museums' managers, employees and visitors were performed in order to know visitors' reactions and emotions during their visits. A questionnaire was developed to test the aforementioned hypotheses. The questionnaire was divided into two parts. The first part covered the experience, mood and the expectations before the visit. The second part referred to the design quality, the disconfirmation of expectations, the pleasure and the satisfaction after the visit. The first survey was conducted during the months of July to October 2009 and the total number of questionnaires distributed was 800. A second set of data was collected through observations and interviews during October, and November 2009, providing valid data for analysis. Those surveyed were asked to answer the first part of the questionnaire, (i.e. the questions referring to their experience, mood and expectations). After answering these

questions, the visitor held onto the questionnaire during the visit, and the second part of the questionnaire was completed upon exit. Of these 800 questionnaires, 613 were returned. One hundred and four questionnaires were excluded (40 incomplete and 64 the age of participants were under 65 years old). The total numbers of questionnaires analysed were 509 questionnaires with observed response rate of 76.6%. Analysis was conducted using the statistical software package SPSS version 17.0 with a sample size of 509, α (the probability of making a correct retention is 0.95) =0.05, df (degree of freedom) = 1.0. Of the 509 respondents, 290 were men (57.4%) and 215 were women (42.6%). Three hundred and forty eight visitors (69.3%) were 65-70 years old, one hundred and forty eight visitors (29.7%) were equal or more 71 to 90 years old. Of the 509 respondents, 271 (53.9%) were locals, and 229 (45.5%) foreigners. Of the locals, 162 were Malay (32.2%), 61 were Chinese (12.1%), 76 were Indian (15.1%), indicating that Malay visitors are more interested in visiting museums than others. Of the 509 Participants, only 43 (8.5%) of elderly visitors came alone to the museum, while 212 (42.1 %) came with friends and 185 (36.7%) came with their families. The rest of participants 60 (11.9%) visited museums with organizations. The scale of expectations is constructed of five items were adapted from the scale proposed by (Rojas and Camarero 2007) and also was applied to the case of museums and exhibition centres. The scale of perceived quality (six items) was prepared from the proposal of Brady and Cronin (2001). All of the included items of expectations were adapted to reflect the context of interior pathway and circulation in museums. The results of the responses (either agree or disagree) were presented under the check-list of three categories obtained from literature review; a) horizontal pathway & circulation design, b) vertical pathway & circulation design, and c) Interior environment and space planning. In horizontal pathway item, the results of the responses (either agree or disagree) were presented under the check-list of six factors based on the literature review such as; horizontal accessibility, halls' arrangement and spaces, corridors and entrance lobbies, waiting areas, orientation system, furniture arrangement and interior layout. In vertical pathway design, the results of the responses (either agree or disagree) were presented under the check-list of three factors based on the literature review such as; vertical accessibility, position, visibility and capacity of lifts, ramps and staircases, and interior paths and circulation. In interior environment item, the results of the responses (either agree or disagree) are presented under the check-list of four factors based on the literature review such as; creativity and interior environment, interior materials and textures, interior lights and interior colours. To measure satisfaction (five items) the Oliver (1996) scale was used and included additional items that

Raed M. A. Elottol and Azizi Bahauddin

measured the intention to repeat the visit and word-of-mouth recommendation. All scales were validated the values of reliability were calculated by the Cronbach alpha in each case. The data in this study have been obtained in three ways: (a) personal observations (qualitative study without a formal survey) on the museums of the study areas, (c) personal oral interviews with the elderly visitors in the study areas, and (c) a survey (quantitative study) of the study area using questionnaires. All the qualitative factors of the circulation and pathway design in the museums are adopted from the previous studies. The answer for satisfactory is "Yes", but when it is unsatisfactory, the answer is "No".

8. Analysis and Results

The first hypothesis (H1) states that there will be significant relationship between elderly visitors' expectation in museum, and design quality perception. The correlation coefficient is -.083- . As the result suggests, a significant negative relationship does not exist (Sig= 0.061); therefore, this can be concluded from these result, that elderly visitors' expectation before they entering the museum don't determine or affect the elderly visitors' perception of the design quality of the interior pathway and circulation in museums. The second hypothesis (H2) stated that the interior pathway design and space planning of museums positively influence the elderly visitors' satisfaction. From the result the correlation coefficient is 0.685 . Sig (2-tailed) or P value is $0.000 \leq \alpha$ 0.05 which can be concluded from these result that there is a positive significant relationship between elderly visitors' satisfaction in museum and interior pathway and circulation design, thus H2 is confirmed that the interior pathway design and space planning of museums positively affect the level of the elderly satisfaction. Results also state that there will be a positive significant relationship between elderly visitors' satisfaction, and time spent within museums. The correlation coefficient is 0.404. As the result, a significant relationship exists; therefore, this can be concluded from these result, that time spent within the museum influenced by elderly visitors' satisfaction , thus time spent within museums consider as a good an indicator of satisfaction. In other words, satisfied visitors tend to spend more time walking in museums. As illustrated in table 1, a whole, it is overwhelmingly clear that in all of the factors under all the different categories, the respondents have until today a far greater negative perception towards interior pathway and circulation design of museums in Malaysia. Such negatively weak perception of the pathway and circulation design towards museums in Malaysia is an expression of their dissatisfaction level in the nature of the circulation designs of these museums. Finally, in the three categories, the respondents have scored 41.03 % < 50% for

qualitative and 43.26 % < 50% for quantitative analysis, suggesting a clear feeling of dissatisfaction towards the interior pathway and circulation design and the interior environments of the selected museums. Table 1, presents a combination of the results of the analyses via a qualitative method with those results obtained via a quantitative method. An integrative examination of the composite data via a combination of methods (in this case quantitative and quantitative procedures) in this way is termed as "triangulation" in this study. Researchers subject data to such a triangulation procedure because such procedure helps counteract threats to validity.

Table 1: Overall composite averages in all categories.

Categories of Factors	Selected 21 Museums	
	"Satisfactory" scores from Qualitative survey	"Satisfactory" scores from Quantitative survey
Interior Pathway Design	41.725 %	44.225 %
Interior Environment and Space Planning	39.66 %	41.33 %
Overall composite average	41.03 %	43.26 %

9. Discussion and Conclusions

This study began with the aim of analyzing a specific aspect of interior design and space planning applied to museums in Malaysia, and the formation of visitors' satisfaction. The first implication of this research is the confirmation of hypotheses due to its high validity and explanatory power. In particular, the respondents selected from the museums in Malaysia have a high level of expectation towards the interior pathway, circulation design and interior environment in museums.   Such positively strong expectation is undoubtedly an expression of their level of experience and trust towards the design industry in Malaysia. Moreover, the Interior pathway and circulation design quality appears to be multidimensional consisting of different three dimensions. The Three dimensions are horizontal pathway design, vertical pathway design, and interior environment of museums. Under each dimension there are many different components. The scores from the survey have demonstrated overwhelmingly same low perceptions and bad expression about the interior pathway design and interior environment in museums in Malaysia. These negative design qualities of the circulation design in museums together with the positive and high expectations of the elderly visitors compositely justify the low level of general satisfaction of the elderly visitors in museums. This being the case, the dissatisfaction seems to have arisen from :The absence of design creativity, the absence or

Raed M. A. Elottol and Azizi Bahauddin

disregard the elderly needs, the insufficient accessibility to interior halls and other spaces, the inflexibility of the halls arrangement and use of the spaces, the lack of waiting areas and comfort seats, the use of poor or inappropriate interior materials and textures, the insufficient design of corridors and pathway design, the insufficient design of orientation system within the museums, the use of poor or inappropriate interior position and design of staircases ramps and lifts, the insufficient design of interior lighting system, the use of poor or inappropriate interior colours, insufficient furniture arrangement and interior layout, interior pathway and circulations in general are not suitable for elderly visitors.   The ideas that interior pathway design and interior environment must be good, as a high percentage of the elderly visitors find it useful and can enhance their satisfaction level. Yet, little thought seems to have been given to what interior pathway is, what is necessary to achieve visitors' circulation efficiency, and what benefits can be expected. Interior designers in Malaysia have not considered effectively the interior pathway design of elderly visitors. Elderly visitors learn more and are to be more satisfied when they are properly circulated and oriented to an exhibition and when the exhibition is designed with an understanding of their needs and abilities.

This will require us to re-think again about interior pathway and circulation design quality of museums in Malaysia. This study has several limitations, as some of the them are: 1) First study - this is the first study of its type and additional research is needed to confirm the results, 2) The results were mixed and full support wasn't obtained for all factors, 3) Unit of Analysis -While it is appeared that the notion of interior circulation design was universal regardless of industry or size, this research limited itself to the study of interior circulation quality at museums environment in Malaysia, 4) Lack of prior relevant research, 5) Generalizing the findings of this study - Due to geographical limitations, participants may possess certain attributes that differ from those in other parts of the world.

Future research may use more diversified random samples to verify the dimensions developed in this study. Interior pathway design could be the trend in museums and visitors' studies in the future, so more studies of this nature should be carried out. However, the interior designers are invited to continue this initial investigation of interior pathway design quality within museums, especially in new areas of design where we knew our user elderly preferences, needs and abilities. Interior circulation elements are a design strategy, a success value and quality indicator of museums design. It is the communication and circulation tools, strategy and

technology that permit the combination of all museums' services and visitors.

10. Acknowledgment

A very special thank you is due to Dr.Siriporn Kobnithikulwong for insightful comments, helping clarify and improve the manuscript.

11. References

Abaci, O., & Kamaraj, I. (2009). Museums as an educational medium: an implementation model. Procedia Social and Behavioral Sciences, 1 (1), 1337-1341.

Amburg, D. V. (2007). Why Customer Satisfaction Matters in the Public Sector. *Digital Citizen, 12*(8), 2-35.

Banning, S. A., & Schoen, M. (2007). Maximizing public relations with the organization–public relationship scale: Measuring a public's perception of an art museum. *Public Relations Review, 33* (1), 437–439.

Beirne, S. (2003). Suzie Beirne m.d.i.a. Usenature (Usenature.com).

Bitgood, S. (1991). Suggested Guidelines for Designing Interactive Exhibits. *Journal of Visitor Vehavior Vol. VI*(No. 4), 111-121.

Bitgood, S. (1992). Visitor Orientation and Circulation: Some General Principles. *Jacksonville State University, Volume VII*(Number 3), 15-30.

Bitgood, S. (1994). Designing Effective Exhibits: Criteria for Success, Exhibit Design Approaches, and Research Stategies. *Journal of visitor Behavior, Volume IX*(Number 4), 4-19.

Bitgood, S. (2005). An Analysis of Visitor Circulation: Movement Patterns and the General Value Principle. *Jacksonville State University, Jacksonville, AL*

Bitgood, S. (2010a). An Analysis of Visitor Circulation: Movement Patterns and the General Value Princip. *Jacksonville State University, 16*(8), 256-264.

Bitgood, S. (2010b). Problems in Visitor Orientation and Circulation. *Jacksonville State University, 14*(7), 155-170.

Bitgood, S. (2010c). The Role of Attention in Designing Effective Interpretive labels. *Journal of Interpretation Research, 5*(2), 31-45.

Bitgood, S. C. (1999). Impact of setting factors on visitors. *Visitor Studies, Volume II*(Issue 2).

Black, G. (2005). *Engaging Museum (Developing Museums for Visitors Involvement)* (6th Edition ed. Vol. 2). New York: Routledge.

Black, J. (2008). Museum Application Design for Older User.

Board of Directors of the Hawaii Public Housing Authority. (2009). Designated Housing For Elderly And Disabled Families. *Hawaii Public Housing Authority*, 1-5.

Bolton, S. (2010). The Task Force on Museums and First Peoples, a Decade Later: A Case Study of the McCord Museum of Canadian History. 22-32.

British Standard. (2009). *Corridors, Lobbies And Paths*.Unpublished manuscript.

Brititsh Standard. (2009). *Horizontal Circulation*.Unpublished manuscript.

Brock. (2007). Pedestrian Circulation. *Brock University Campus Plan*.

Burns, G., & Bowling, N. (2009). Dispositional Approach to Customer Satisfaction and Behavior. *Springer Science and Business Media, 9*(1), 99–107.

Butterworth, M. (2007). Railway Museum (Advancing Railway Preservation). *Journal of the Association of Railway Museums, 45*(1), 2-20.

Canada Science and Technology Museum Corporation. (2009). *Corporate Plan Summary* Unpublished manuscript.

Canadian Museums Association. (2006). *Museums For Tomorrow*. Canada Routledge.

Carney, J. (2009). An initiative for a new index and opinion survey to measure satisfaction amongst customers of the commercial property industry. *RICS, 12*(2), 46-50.

Ching, F. D. K. (2004). *Architecture: Form. Space & Order* (Vol. 3). New York: Van Nostrand Reinhold Company.

Code, C. D. (2003). *Access, Egress, and Circulation*.Unpublished manuscript, City of St. Helens - Community Development Code.

Communities, T. W. G. o. M. a. S. (2003). *Museums and Sustainable Communities*.Unpublished manuscript.

Community Council of Devon. (2006). *Access & Awareness Project 2005-2008, A&A Information Sheet 9 (CORRIDORS & CIRCULATION)*.Unpublished manuscript.

Crayford, M. (2006). Navigating The Museum. *Australian National Maritime Museum, 13*(2), 303-309.

Cusiima. (2010). *Circulation- Specific Plan*.Unpublished manuscript.

Dalke, H., Little, J., Niemann, E., Camgoz, N., Steadman, G., Hill, S. (2006). Colour and lighting in hospital design. *Journal of Optics and Laser Technology 38*(1), 343–365.

Davey, G. (2006). An Hourly Variation in Zoo Visitor Interest: Measurement and Significance for Animal Welfare Research. *Journal Of Applied Animal Welfare Science, 9*(3), 249–256.

Department of Finance and Personnel. (2010). *Building Regulations Part R - Access To And Use Of Buildings*.Unpublished manuscript.

Department of Statistics in Malaysia. (2009). *Socio-Economic Characteristics Of The Elderly In Malaysia*.Unpublished manuscript.

Foster, D. (2010). *Measuring Customer Satisfaction In The Tourism Industry*. Paper presented at the Third International & Sixth National Research Conference on Quality Management.

Foster, J., Koran, J., MaryKoran, Stark, S., Blackwood, A., & Landers, H. (2009). *The Effect of Multispecies Exhibits on Visitor Attention at The Jacksonville Zoological Park*.Unpublished manuscript, Gainesville, Florida.

Goodman, L., Gallant, G., Brown, J., & Miller, S. (2010). Design Consideration in Developing Alternative Housing. *Government of Canada and the City of Toronto., 21*(2), 2-29.

Goor-balk, A. v., Warmerdam, L., Ghameshlou, Z., & Masurel, E. (2010). satisfacation among Museum Visitors: The Holistic Approach Confirmed Empirical Evidence from the Anne Frank House Visitors. *Cultural Economics, 43*(7), 14-30.

Gotlieb, & Brown. (1994). Consumer Satisfaction And Precieved Quality. *Journal of Applied Psychology, 79(6), 875-885.*

Guidlines, D. (2009). *Circulation Areas*.Unpublished manuscript.

Gutwill, J. P. (2006). Labels for Open-ended Exhibits: Using Questions and Suggestions to Motivate Physical Activity. *Visitor Studies Today, Volume 9*(Issue 1).

Hall, J., Basarin, V. J., & Lockstone-Binney, L. (2010). An empirical analysis of attendance at a commemorative event: Anzac Day at Gallipoli. *International Journal of Hospitality Management, 29* (1), 245–253.

Han, S.-J., & Cho, S.-B. (2006). Predicting User's Movement with a Combination of Self-Organizing Map and Markov Model. *Springer-Verlag Berlin Heidelberg, 2*(4), 884–893.

Haywood, N., & Cairns, P. (2010). Engagement with an Interactive Museum Exhibit. *UCL Interaction Centre, London WCIE 7DP, UK, 12*(2), 113-129.

Heath, C., & Lehn, D. v. (2010). Interaction and Interactives. *King's College London, 7*(2), 13-37.

Hendon, R. C. (2010). Arts Participation: Comparing The Elderly and Non-Elderly. 83-83.

Holjevac, I. A., Marković, S., & Raspor, S. (2010). Customer Satisfaction Measurement In Hotel Industry: Content Analysis Study. *University of Rijeka, 12*(1), 31-40.

Holl's, S. (2010). Lighting Up The Midwest. *Museum, Kansas City, Usa, 14*(9), 41-50.

Hsu, L. (2004). Circulation in Museums. *2*(3), 122-150

J.A.Renshaw. (2006). Getting a Measure of Satisfaction from Eye Tracking in Practice. *School of Computing Leeds Metropolitan University, UK, 14*(6), 78-81.

Jeong, J.-H., & Lee, K.-H. (2006). The physical environment in museums and its effects on visitors' satisfaction. *Building and Environment, 41* (1), 963–969.

John J. Koran, Jr., M. L. K., & Foster, J. S. (2010). The (potential) Contributions of Cognitive psychology to visitor studies. *The University of Florida, Gainesville*.

Jun, J., Kyle, G., & O'Leary, J. T. (2006). Perceived Constraints To Art Museum Attendance. *Northeastern Recreation Research Symposium, 14*(2), 459-466.

Katz, P. (1994,). A Quantitative And Qualitative Analysis Of Natural Daylighting In Modern And Pre-Modern Architecture: Let There Be Light . *University of*

Wisconsin-Milwaukee, 3(3), 86-100.

Kaynar, I. (2010). Visibility, movement paths and preferences in open plan museums: An observational and descriptive study of the Ann Arbor Hands-on Museum. *Journal of University of Michigan, II*(5), 150-162.

Khan, & Syed, S. (2009). Risk Factors For Depression; Findings Of A Descriptive Study Conducted In Penang, Malaysia. *Journal of Clinical and Diagnostic Research, 3*(6), 1859-1866.

Khattar, V. (2006). QoS and Customer Satisfaction: A Study. *Pipeline 3*(2), 56-60.

Kinsella, K., & Phillips, D. R. (2005). Global Aging: The Challenge of Success. *A publication of the Population Reference Bureau, Vol. 60,* (1), 201-244.

Korn, R. (1994). Studying Your Visitors: Where To Begin. *History News, 49*(2), 23-29.

Martı´n-Ruiz, D., Castellanos-Verdugo, M., & Oviedo-Garcıa, M. d. l. A. (2009). A visitors' evaluation index for a visit to an archaeological site. *Tourism Management, xxx*(1), 1–7.

Mat, R., & Taha, H. M. (2003). *Socio-Economic Characteristics of The Elderly In Malaysia.* Paper presented at the 21st Population Census Conference 19 – 21 November 2003

Mattsson, J. (2009). Listening to customers in face-to-face service encounters. *Department of Communication, Business and Information Technologies - Roskilde University, 5*(2), 3-25.

Meng. (2009). Built Heritage vs Accessibility. Retrieved 09-02-2009: http://www.pmh83.blogspot.com

Oliver. (1996). *A Behavioral Perspective on the Consumer* (1st Edition ed. Vol. 2). Boston, Mass.: Irwin- Me Graw-Hill.

Parasuraman, Berry, & Zeithaml, V. A. (1994). Reassessment of Expectations as a Comparison Standard in Measuring Service Quality. *Journal of Marketing, vol. 58, no, 1, pp 111-124.*

Pearlmutter, D., Berliner, P., & Shaviv, E. (2006). Physical modeling of pedestrian energy exchange within the urban canopy. *Building and Environment, 41* (1), 783–795.

Pile, J. F. (2010). *Interior Design*   (3rd Edition ed. Vol. 1). London Sage Inc.

Sites' invistigations   and museums' observations (2009).

Reussner, E. M. (2004). Best Practices in Audience Research and Evaluation Case Studies of Australian and New Zealand Museums. *Volume VII Issue II Visitor Studies Today.*

Ritchie, I. (1994). Bonn: Museum Of Contemporary Art- East Meets West Ian Ritchie Statements About Adapted Historical Architecture. *Ian Ritchie, 2*(2), 92-98.

Roberts, D. C., McKay, M. P., & Shaffer, A. (2008). Increasing Rates of Emergency Department Visits for Elderly Patients in the United States, 1993 to 2003. *Annals of Emergency Medicine, 51*(6), 769-774.

Rogers, M. L. (1998). *An exploration of factors affecting customer satisfaction with selected*

*Corresponding author (Raed M. A. Elottol). Tel/Fax: +60174405868 . E-mail addresses: aaraed@yahoo.com.

history museum stores.. Texas Tech University, Texas

Rohloff, I. K., Psarra, S., & Wineman, J. (2009). Experiencing Museum Gallery Layouts through Local and Global Visibility Properties in Morphology (An inquiry on the YCBA, the MoMA and the HMA). *the 7th International Space Syntax Symposium, 7*(2), 94-108.

Rojas, C. d., & Camarero, C. (2008). Visitors' experience, mood and satisfaction in a heritage context: Evidence from an interpretation center. *Tourism Management, 29*(1), 525–537.

Rounds, J. (2006). Doing Identity Work in Museums. *Curator: The Museum Journal, 49*(2), 133-150.

Sakkas, N., & Pe´rez, J. (2006). Elaborating metrics for the accessibility of buildings. *Computers, Environment and Urban Systems, 30* (1), 661–685.

Satoh, I. (2008). Context-Aware Agents to Guide Visitors in Museums. *National Institute of Informatics, 12*(2), 441–455.

Sharma, K., & Dhariya, T. D. (2006). Towards an inclusive, barrier free and right based society. *empowerpoor, 2*(4), 1-16.

Sheeks, A. (2006). Fort Worth Museum of Modern Art (Tadao Ando).

Sookhanaphibarn, K., & Thawonmas, R. (2009.). A Movement Data Analysis and Synthesis Tool for Museum Visitors' Behaviors. *Springer-Verlag Berlin Heidelberg, 3*(1), 44–154.

Taha, D. D. A. H. (2008). *Museums In Malaysia: Challenges And Development*.Unpublished manuscript, Kuala Lumpur.

The International Council of Museums. (2009). Definition of Terms.   Retrieved 15 October, 2010, from http://icom.museum/statutes.html#2

Tran, L. U. (2008). The professionalization of educators in science museums and centers. *Journal of Science Communication, 7*(4), 211-226.

Tufts, S., & Milne, S. (1999). Museums: A Supply-Side Perspective. *Annals of Tourism Research, 26*(3), 613-631.

Wavell, C., Baxter, G., Johnson, I., & Williams, D. (2002). *Impact Evaluation Of Museums, Archives And Libraries: Available Evidence Project*: The Robert Gordon University.

Webb, R. C. (2010). Comparing High-Involved and Low-Involved Visitors: A Review of the Consumer Behavior Literature. *Suffolk University, Boston, Massachusetts*

Weisman, G. (1983). Way Finding and Architectural Legibility: Design Considerations in Housing for the Elderly," in Housing for the Elderly: Satisfaction and Preferences. *U. Regnier and J. Pynoos, eds. New York: Garland Press.*

Weissmann., A. J., & Islam., R. (1996). Traffic   circulation study and   long-range plan *Texas Department of Transportation Research and Technology Transfer   17*(1), 109-236.

Wener, Richard, & Robert Kaminoff. (1982). "Improving Environmental Infor¬mation: Effects of Signs on Perceived Crowding and Behavior," *Environment and Behavior 14, no. 6: 671-94.*

Wener, R. E. (1998). The Environmental Psychology of Service Encounters. *Environmental Psychology '103*.

Wener, R. E. (2002). The Environmental Psychology of Service Encounters. *The Service Encounter.*

Wong, S. H., Rajikan, R., Das, S., Yusoff, N. A. M., Lee, L. K., Aziz., S. A. (2010). Antioxidant Intake and Mild Cognitive Impairment Among Elderly People in Klang Valley: A Pilot Study. *Journal of Sains Malaysiana, 4*(39), 689–696.

Wunsch, H., Jones, A. T., & Scales, D. C. (2010). Intensive Care for the Elderly: Current and Future Concerns. 935-943.

Yalowitz, S. S. (2002). Personality and Motivation in Visitor Satisfaction. *journal of visitor studies today, 4*(3), 214-217.

Yenawine, P. (2002). Interactive Learning in Museums of Art and Design 'Notes on Aesthetic Understanding and Its Development'. *Visual Understanding in Education, New York, 12*(3), 23-28.

Yin, R. K. (2003). *Case Study- Research Design And Methods* (3rd Edition ed. Vol. 2). California: Sage Publication.

Zelanski, P., & Fisher, M. P. (2010). Design Principles And Problem S. *Awareness Of Design 23*(2), 3-31.

Zorloni, A., & Wien, K. (2010). Achieving excellence: Investigation into the use of performance indicator in museums. *IULM University, I*(5), 230-245.

Dr.AZIZI BAHAUDDIN is currently Associate Professor in Interior Design at the School of Housing, Building & Planning, Universiti Sains Malaysia. His main research areas are focusing on Exhibition Design/Interior Design; Art and Design especially researching on Cultural Issues and Ethnography, and in Architectural and Cultural Heritage in Tourism.

RAED M. A. Elottol is currently a PhD candidate in Interior Design at the School of Housing, Building & Planning, Universiti Sains Malaysia. His main research areas are focusing on Museums; Space Planning/Interior Design; Architecture especially researching on Cultural Issues and Building Technology.

Peer Review: This article has been internationally peer-reviewed and accepted for publication according to the guidelines given at the journal's website.