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Flexible House Attributes As Perceived By The End-Users

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Abstract

Flexibility is vital in housing unit design to allow more choices for users, such that they perceive control over their living environment. However, flexible house design thus far has been viewed in the literature as the output of designer's predictions about users' future changing needs. It is arguable that if the users were allowed to identify the attributes that they need to be flexible, then flexible house design would be more relevant and effective. This article is focused on flexibility in house design based on user preferences that are mainly influenced by his/her values and is based on the authors' study of 25 respondents from Universiti Teknologi Malaysia, Johor, Malaysia using the Means-End Chain (MEC) research model. The findings from this study suggest a number of important attributes of flexibility in house design, such the ability to modify window size and the possibility of enlarging some rooms. These attributes are potentially useful for designers because they facilitate design manipulation.

Keywords: Flexibility in house design, House Attributes, Housing Preferences, Means- End Chain (MEC), User-Value.

1. Introduction. The Centrality of Flexibility in house design

Veitch and Gifford (1996) posit that providing more options or choices in the physical environment may increase users' perceived control and provide improved well-being. This idea indicates the centrality of flexibility in housing design. Many studies have asked what elements and features should be flexible in building design in general and in house design in particular. Flexibility in house design may lead to varied levels of user participation, ranging from deciding on furniture, fixtures and equipment (Kendall, 1999) to more active user involvement in redesigning the entire house (Friedman, 2002). Schneider and Till (2005) suggest some essential flexible housing

components that make dwelling easily adaptable for users. The authors stress the importance of flexible design in relation to the amount of space that can be achieved by the user. Beisi (1995, 2004) suggests that a house can be designed using flexible elements and furniture such that the user can easily change attributes and elements within the house depending on time of day to suit his everyday activities. However, most of the options and attributes of flexibility in building design have been suggested based on the researcher's predictions.

2.0 Flexible House Design as Predicted by Researchers

Attributes of flexibility in building design have been the subject of many studies. Most researchers list the attributes of flexibility according to their predictions and expectations of the level of flexibility that users might need in the future.

Examples of models of flexible building and housing design include Open Building (OB) (Kendall and Teicher, 2000, Kendall, 1999) which is based on the Support theory developed by Habraken (1972). This model is assumed to accommodate a specific type of user participation after occupancy, which is known as FFE: furniture, fixtures, and equipment.

Friedman (1994, 2002) refers to another model, the Extending Core Plan (EC), which accommodates two forms of renovation. The first form is add-in, which accommodates adding space within house plan boundaries. The second form is add-on, which allows the addition of space both horizontally and vertically.

Other studies propose various principles and applications of flexibility in house unit design. For example, Schneider and Till (2005) connect the level of flexibility in a design with the amount of space. Beisi (1995, 2004) suggests applications of flexibility using demountable walls and flexible furniture. A number of attributes related to flexibility in the installation of building equipment are considered by Geradets (2009) the main attributes with which to assess flexibility in building design. Albostan (2009) focuses on ways to apply flexibility in multi-residential projects using technology and construction techniques to achieve two types of flexibility: initial and/or permanent. The author specified a number of themes to achieve flexibility, including structure, the position of service space, and Architectural layout. All these and many other valuable concepts and theories regarding flexibility in building design or house design focus on the proper methods, techniques, stages, levels and models of flexibility to be achieved, based mainly on the thoughts and predictions of designers.

3.0 Flexibility as perceived by end users

Flexibility also means Modifiability and long- term adaptability, which are assumed to be the responsibility of the investor client (Saari, 2008; Kendall, 2000). However, a user's modifications and renovations of his/her house may go beyond the predictions and expectations of the designer. Indeed, only the end-users themselves are able to establish their meanings of home (Rapoport, 1982). Houses are expected to be personalized by the end-user such that the houses are functionally and symbolically

appropriate for him/her (Sadalla, 1987; Rapoport, 2000). Therefore, it can be assumed not only users are expected to identify which house attributes are suitable for them but also that users should also be allowed to identify which physical components of the house necessarily remain flexible. This assumption presents a notable gap in the relevant body of knowledge.

This article discusses user-preferred flexible house attributes that can be used for design manipulation. The attributes are obtained using the Means- End Chain (MEC) research model. The authors argue that flexible house attributes derived using the MEC model are more relevant for the user due to the nature of the model, which links the selected attributes to user values that are important determinants in attribute selection. The methods used during data collection – a semi-structured interview known as a laddering interview – allows data to be obtained directly from the perception of the users. Jusan (2007, 2010) uses the MEC model to elicit users' preferences in personalizing their houses, and his findings proved that the MEC model is able to link housing attributes and users' values. Bako and Jusan (2012) also use MEC to elicit user preferences and choices for floor finishes based on users' values and motivations.

4.0 The Theory of Means-End Chain

Means-end chain (MEC) is the research model used to establish attributes of flexibility in house design. Means End Chain was invented by (Gutman, 1982) to study consumer choice behavior. The model depends mainly on the linkages between attribute, consequence and values to establish which attributes of goods or products are relevant to the user. Lindberg et al. (1989) refer to the MEC as a way to define the relations between goods and consumers, where each product is characterized by a number of attributes. Reynolds and Gutman (1988) discuss a comprehensive MEC research method that focuses on the linkage between a product and the consequences of using it, and users' values. Laddering, or in-depth interview, is the main technique employed to elicit the data used for the MEC investigation. The house, as another form of product, is also defined as a collection or bundle of attributes (Coolen and Hokestra, 2001), or as a set of attributes (Jusan, 2010). Lindberg et al. (1989) refer to these attributes as means. According to this theory, a user's choice of specific attributes – perceived as preferences – is influenced by values (Coolen and Hokestra, 2001).

The consequences of a user's choice can be either positive or negative, and there can be functional or psychological outcomes of the user's consumption (Geradets, 2009; Jusan, 2010). According to Lundgren (2010), consumers are not primarily interested in project attributes; instead, they are interested in the experiences they can gain from owning the product. These experiences are defined as consequences that are motivated and evaluated by values (Gutman, 1982; Lundgren, 2010). Choice is a dynamic process in which people determine their objectives on the basis of their values, search for suitable solutions, evaluate these solutions and finally make a choice (Coolen and Hokestra, 2001). The value system considered in the traditional MEC research model is developed from the value system presented in

(Rokeach, 1973). Current housing research using MEC (Coolen and Hokestra, 2001; Jusan, 2010; Bako and Jusan, 2012) employ value domains (Schwartz, 1994) that are extensions of the value system presented in (Rokeach, 1973). Jusan (2010) and Coolen and Hoekstra (2001) regard the application of Schwartz (1994) as more appropriate to the current housing context.

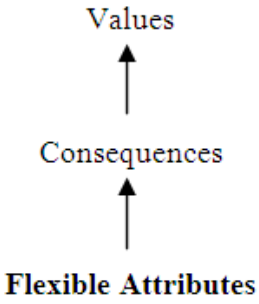
5.0 Methods

Although commercial computer software is available for MEC studies, these products are intended for merchandise product fields and are less appropriate for use in the study of housing. Therefore, the authors decided to adopt the MEC research model employed by (Jusan, 2007; 2010, Coolen and Hokestra, 2001). This article is based on a study carried in 2012 using the Laddering interview technique with 25 respondents. The respondents are randomly selected Malaysian postgraduate students or staff at the Universiti Teknologi Malaysia (UTM) campus in Johor city in Malaysia. Most of the respondents are female, and only 5 are male. The age of the respondents range from 25 to 50 years old. Seventeen respondents are married, and 8 are single. The average interview duration is approximately one hour per respondent.

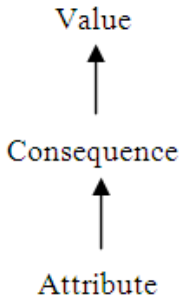
5.1 Data Collection

All techniques used in the data collection were intended to ensure that all elicited data within all categories (attribute, consequence and value) are completely based on the perceptions of the respondents. The techniques used by (Alaraji and Jusan, 2014; Jusan, 2010; Coolen and Hokestra, 2001) have been employed with minor modifications to suit the nature of this study. The interview began by eliciting the flexible attributes and was dominated by the question "what" to identify expected changes that the respondent expects to need to make in future. The respondents were asked to name their preferred specific attributes of flexibility in house design, which they expect to allow modifications and renovations to be made as desired. The authors had to use simple and clear terms because not all respondents are familiar with terms used in flexible design. In the event that the respondent could not identify what they expect or how to respond, the interviewer shows a list of attributes that is prepared prior to the interview. The list was intended only as a guide to help the respondents in answering the questions (Coolen and Hokestra, 2001). The authors were careful not to make any suggestion or pose any leading questions that might persuade the respondents to choose any particular elements within the list.

Having established a list of attributes of flexibility in house design, the laddering interview was begun by repeating the question "why is it important to you?" This question is used to establish links between users' preferred attributes, consequences and values. The interviews are based on a hypothetical flexible house design and are recorded using an MP3 audio recorder. The conversations are then transcribed to perform content analysis and to construct Ladders for each respondent. Examples of the categorization of raw ladders are shown below:



Flexible Attributes
This categorization is based on Reynold and Gutman, (1988), which used the following scheme.



5.2 Data Analysis and Categorization

To analyze the collected data, the authors adopted the technique of content analysis, as used by Jusan, 2010. The process begins by transcribing the recorded interview as text. Codes are assigned for repeated and/or important meanings within single words, phrases, or sentences. Each code represents a flexible attribute perceived by the respondents. Codes are also assigned for elements in the value and consequence categories and used in the Summary of Implications Matrix (SIM) and in all Hierarchical Value Maps (HVM).

5.3 Construction of the SIM and HVM

All raw ladders are used to establish the summary of implications matrix, SIM, which is a table showing the number of times that each element is linked (directly or indirectly) to other elements. The data in the SIM are used to construct the hierarchical value map, HVM. Gutman (1982) recommends the use of cut-off levels from 3-5 to construct the hierarchical value map (HVM) appropriately. The authors adopt 4 as the cut-off level that implies that only elements that are linked to other elements 4 times or more in the ladders will be included in the formation of the HVM. Here, HVMs are constructed for each main space in a house as well as the house as a whole.

5.4 Interpretation of the HVM

The constructed HVM of the entire house is used to identify important flexible attributes in a house. Because values are mainly guided by users' choice behaviors, interpretations are conducted based on the main chain of flexible attribute/consequence/value. Each preferred flexible attribute is connected to and influenced by a specific value. All numerical values from each perceptual orientation path or chain are calculated to identify the strength of each attribute; these attributes are then ranked, as shown in Table 5.

6.0 Results and Discussion

The results show that users' preferences for flexibility attributes in house design varied among the rooms in a house and the house viewed as a whole. For this reason, the authors decided to construct the HVMs separately for each space. Jusan (2007; 2010) also observed that respondents were more concerned with personalizing specific spaces than personalizing the entire house holistically. Due to the limited length of this article, the authors will only discuss HVM for the house as a whole. Additional discussions on the most preferred flexibility attributes derived from other HVMs concerning specific spaces in the house are also included where necessary.

The results suggest that respondents are concerned more with flexibility in the design of the living room, kitchen, dining room, master bedroom, and bedrooms. (Saruwono et al.,2012; Jusan, 2007) refer to living room as a representational space of the family and mention that this is one of the motivations for Malaysians to renovate this space. Similarly, Aragonés et al. (2010) noted that the personalization of this space was significant. Jusan (2007; 2010) highlights the importance of kitchen space and mentions that people renovate this space as well as the bathroom and porch. Omar (2010, 2012) also refers to the kitchen area and bedrooms as important spaces that Malaysians consider to be important to renovate. However, the findings presented here show that respondents appear less concerned with flexibility in the bathroom, house façade, porch and garden, doors, ceilings, window location and number, and materials.

Surprisingly, the results do not indicate that respondents are interest in having flexibility in outdoor spaces and the house façade; this is different than those reported in Jusan (2010), which show that outdoor space (the forecourt) is the second focus of renovation in Malaysian house design after the living room. This might be because the area of the outdoor space addressed in this study is much larger than the forecourt area. Forecourts are small areas in front of terraced houses that are normally used in Malaysia as car porches with tiny turfed areas. Therefore, the cost of renovating the larger outdoor area tends to be much higher; Jusan (2010) finds the cost of renovating this area to be 20% of the cost of renovating an entire house in Malaysia.

The outdoor space of a house is considered as an open or free space where users can carry out whatever modifications they desire, whenever they want, with some obvious limitations; in particular, they may not exceed the house boundaries as a building. However, respondents think about indoor redesigns that are impossible and might wish that these areas were flexible enough to allow them to carry out

modifications easily without the expected high cost. This study concluded that respondents prefer having demountable partitions between the living and dining room rather than heavy walls, thereby allowing spatial improvement without additional cost.

Another reason is provided by the conclusions of Omer (2010; 2012) i.e., that people are more interested more in renovations of spaces such as kitchens and bedrooms because of the resulting functional consequences, which might be more important than modifying other spaces without functional consequences as referred by Omar (2010).

The HVM shown in Figure 1 depicts the influence of user values on their preferences for flexible attributes in the overall house design, which include family security (FS), hedonism (HE), benevolence (BE), and self-image (SD self-direction).

Earlier works by Omar (2010; 2012) found that extending space is the most common tendency in renovation works in Malaysia. However, results obtained using the perceptual orientation path (Figure 1) show a number of preferable flexibility attributes in house design. Table 1 is an example of how the results in HVM transformed in tables. According to this artcl, the authors present one table as a example. Table 1 explains the consequences and values associated with preferred flexible attributes. From Figure 1, the results suggest that (MFA) and (ADD-in) are the most preferred attributes for flexibility in house design. Modifiability of furniture from time to time is considered highly desirable by respondents because of its effects in changing mood and its role in providing comfortable space. However, (ADD-in) is still apparent in the interview responses and the results also suggest that respondents preferred (ADD-on), especially bedrooms. Finally, (MWC) is also preferred to satisfy Aesthetic preferences. These attributes are influenced by (HE) value and are ranked according to the total numerical value of HE path, as shown in Table 1. Another path in this HVM (Figure 1) shows that (ADD-in) using demountable or flexible walls is considered as a preferred attribute. This is similar to the findings of Jusan (2007; 2010); most respondents preferred flexible walls, especially between the living and dining rooms, so that they can control the size of the space for family gatherings and social events. Another important attribute is (MWC) of the entire house. Adding a floor vertically (ADF) is also preferred but is considered less important. These attributes are influenced by the value of (SD) and are ranked according to the total numerical value of SD path.

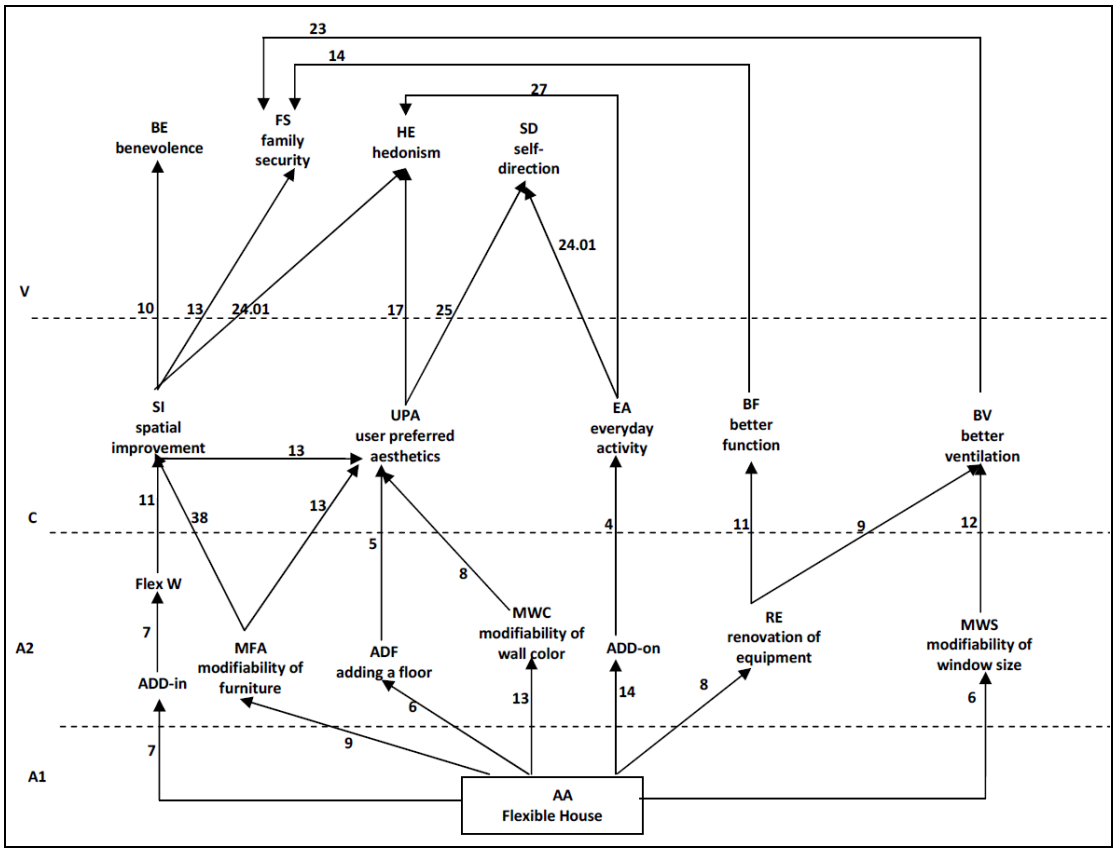


Figure (1): The HVM of the entire house.

Modifiability of window size (MWS) and the possibility of renovating home equipment (RE) are considered the most important attributes of flexibility to achieve greater family security. Again, ADD-in is considered important to satisfying the value of family security. On occasions such as family gatherings with relatives and visitors, people tend to separate female from male gatherings into two living rooms by using flexible walls. Sometimes, people extend the living room by removing flexible walls. These attributes are influenced by the value of (FS) and are ranked according to the total numerical value of its path.

The results show that (MFA) and (ADD-in) are the most preferred attributes to improve the interior environment for the respondents and their relatives in association with BE value.

Important attributes are identified by observing the perceptual orientation paths of the elements in all HVMs, which are expressed numerically (Table 2). This table shows that there are eight main preferred attributes of flexibility in house design to cope with user's preferences and values, ranking from 1 to 8.

Table 1: Ranking of the flexibility attributes in house design that are influenced by the value of SD value

Ranking	Flexible attributes are influenced by the value of SD		Consequence	Consequence	SD value	Total numerical value of the path
1	(7) ADD-in	(7) Flex W.	(11) SI	(13) UPA	25	63
2	(9) MFA			(13) UPA	25	47
3	(13) MWC			(8) UPA	25	46
4	(14)ADD-on			(4) EA	25	43
5	(6) ADF			(5) UPA	25	36

Table 2: Ranking of the most preferred attributes of flexibility in house design (derived from the HVM shown in Figure 1 and other HVMs)

Ranking	Attributes of flexibility	House attributes	Values
1	Modifiability of furniture (MFA)	Living room	(92)* Hedonism
		Whole house	(72) Hedonism
		Master bedroom	(79) Hedonism
		Bedroom	(71) Family security
2	Enlarging a room(EN)	Kitchen	(82) Hedonism
		Bedroom	(81) Hedonism
		Living room	(74) Hedonism
		Dining room	(69) Hedonism
3	Modifiability of floor covering (MFC)	Living room	(64) Self- image
		Bedroom	(54) Self-image
		Kitchen	(42) Hedonism
4	Modifiability of wall color (MWC)	Living room	(53) Self-direction
		Whole house	(46) self-direction
		Bedroom	(46) self-direction
5	Adding a room without changing plan (ADD-in)	Using flexible wall between living and dining rooms	(50) Hedonism
			(35) Benevolence
6	Adding a room with changing plan (ADD-on)	Whole house	(45) Hedonism
7	Modifiability of window size (MWS)	Whole house	(41)family security
		Living room	(41)family security
8	Possibility to renovate equipment (RE)	Kitchen	(41) family security
		Whole house	(40) family security

(Number)*: total amount of numerical values from perceptual orientation path from HVMs

These attributes are MFA, EN, MFC, MWC, ADD-in, ADD-on, MWS, and RE. The results of this study first reveal that users' perceptions of flexibility in house design in Malaysia is mainly motivated by their needs and influenced by their tendency to change and renovate their houses easily. Second, most respondents' preferences define their intentions to improve the interior space and obtain a more secure living environment at little or no cost. Finally, the respondents perceived flexibility to apply to the environment inside the house and not to include outdoor house design.

7.0 Conclusions

This article attempts to establish attributes of flexibility in house design as perceived by users. The major findings of this study include the expected attributes of flexible house design that accommodate future modifications. The results can be considered as more relevant than findings from previous studies because they were derived directly from the perceptions of end users.

In contrast to the findings of Jusan (2007; 2010), in which most of the renovators modified the major structural components of their houses, the most preferred means of flexibility appears to be the used of demountable partitions (ADD-in) and flexible furniture (MFA). This is an interesting finding of this study and suggests that serious effort must be undertaken by architects to ensure that future design changes should not involve the modification of heavy structural components of the houses.

The results suggest that components such as floor finish, living room size, furniture layout and window design, etc. are better decided by the end-users themselves rather than the architect. Hence, in economic terms, the findings suggest that because allowing users to participate in the delivery of their homes is not an option, it is essential to minimize financial burdens due to future substantial renovation works.

The architect's role in providing suitable housing design to accommodate future modification may be assisted by a suitable knowledge of the user's expectations of flexible house components. The findings of this study do not yet offer generalized guides for practical implementation. However, by further expanding this research, the findings will provide a useful guide for designers to devise appropriate flexible house components to accommodate future house modification affordably. This suggests that the current practice in providing housing Malaysia needs to be reviewed.

It is interesting to put the findings of this study into the context of the Malaysian Government's efforts to adopt the concept of 'build-then-sell' (BTS) as a main concept in housing delivery. One of the advantages of this approach is that it protects the purchaser from contractors who might collect the deposit and disappear, leaving the purchaser with no house. It can be assumed that the standard, ready-made house design (the form of housing design offered according to this concept to house buyers) might not be able to accommodate individual users' preferences and needs. Furthermore, the findings of this study suggest that the participation of users in

designing their own homes is essential rather than a luxury. However, the findings of this study might support the concept of (BTS) if user participation is accommodated by providing flexible house attributes. This effect would allow users to accommodate their specific and changing needs.

8.0 **References**

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