Evaluation System for Psychological Comfort towards Korean Traditional Residence

Mu-Jin Jo[1], Seulki Kim[2] and Seung-Hoon Han[3]

Abstract—The purpose of this study is to suggest a standard comfort features presented on the consideration of the traditional houses, called Hanok in Korea. In addition, this paper is to build a diversified, integrated evaluation system considering traditional, aesthetic and psychological values. For this study, the degree of integrative comfort was analyzed and comfort performance has been classified. Comfort performance was divided into two large comfort performance categories: physical and psychological. For this research, survey data from residents were collected for evaluating psychological comfort. Existing relevant studies about comfort evaluation system were driven to reveal the quantitative comfort elements of the suggested classification system. This study also contains a qualitative in-depth analysis of the comfort factor and will examine the effect of those elements. This study has finally proposed an integrated comfort evaluation system that can evaluate over inhabitants of the interior environmental conditions and surveys. As a result, the proposed system will have to be turned on quite good applicability in the field.

Keywords— Comfort Performance, Integrative Evaluation System, Korean Traditional Residence, Psychological Comfort.

I. INTRODUCTION

CURRENTLY there are standards and regulations related to the comfort evaluation of physical environment. However, the integrated evaluation of the emotional and psychological comfort is not presented successfully, although physical living environment such as temperature, humidity, noise and lighting conditions is very important.

These physical evaluation systems and analysis skills have continuously been evolved. However, the way of life for the residents became more complex and complicated, and their requirements are being increased. This is why evaluating only physical comfort factor is not enough. Therefore, the purpose of this study is to suggest an integrated comfort evaluation system through analyses of psychological comfort factors.

Despite of many traditionally known advantages, Hanok residences are being marginalized, because their building performances are normally recognized as poorer than those of modern houses in the scope of physical environmental performances. The reason is that energy efficiency from the physical environment is just emphasized as the most important factor among comfort performance evaluation indexes. That is why evaluating both physical and psychological comfort factors in balance is becoming important to help users operate their spaces more positively.

Through this study, it is suggested that the system can accurately evaluate the comfort and value of Korean traditional houses. Furthermore, standardized evaluation methods for Hanok will be presented.

II. SCOPE AND METHOD OF RESEARCH

A. Scope Of Research

This study has set the test unit as a Korean traditional house located at Jooknokwon, in Damyang, Korea. The size of the target has been planned as a one-story house. In the house, there are three rooms and a bathroom. In addition, actual residents are living for providing survey answers.

Fig. 1 Test-Bed Module For Comfort Assessment
(Damyang, Jeollanam-Do, Korea)

With setting test-bed module as a Korean traditional house, special psychological comfort factors have been indexed. Most factors have been induced from previous cases and researches. Those factors will be collected by each device and the estimated information of them will used for evaluation of integrative environmental comfort performance.

The purpose of this study is to evaluate how to classify comfort factors according to the modernized Hanok containing diversities of the way of life. The existing comfort evaluation methods have focused on physical elements, and essential human senses and crucial psychological factors have been excluded. In particular, the traditional residence in Korea, Hanok is difficult to assess by the existing evaluation methods, because it has characteristics as a wide variety of emotional, aesthetic and psychological values.

Mu-Jin Jo[1] is in Master's program in Architectural Engineering with Graduate School of Chonnam National University, Gwangju 500-757, Korea

Seulki Kim[2] is a Researcher at Integrated Architectural Design Studio with Chonnam National University, Gwangju 500-757, Korea

Seung-Hoon Han[3] is the corresponding author and a Professor of Architecture at Chonnam National University, Gwangju 500-757, Korea

B. Research Methods

This study has analyzed comfort factors, and as a result, it was confirmed that both physical and psychological comfort zones could be separated by two areas, reconstructed and listed with comfort factors with examining existing researches.

Results are listed through the number of elements with preceding analysis, and it was possible to find a common sense classification between psychological and physical comfort areas. Most of the physical and psychological comfort factors can be sensed through vision, auditory, tactility and smell. This survey has been put together by a systematic, objective comfort configuration using five sensory systems in the physical and psychological comfort zones.
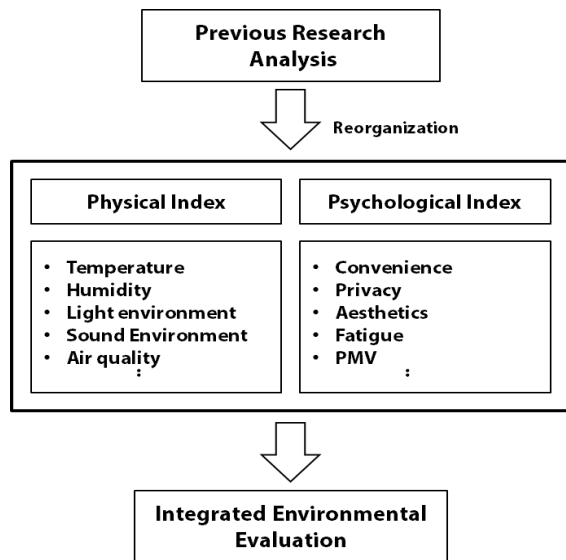
Fig. 2 Evaluation For Environmental Comfort

Psychological factors were classified according to itemized standard in order to calculate psychological comfort value of Hanok residence, and survey results based on standard were calculated the average and accumulated percent. The relative importance was accord to each article.

Comfort elements have been classified as shown in the above diagram used to evaluate the relative importance of the AHP (Analytic Hierarchy Process). Relative importance of the evaluation could be carried out by a survey of experts. With using the AHP to determine the relative importance of the comfort factor, the respective factor has been measured. Physical factors such as temperature, humidity, air quality are measured by sensors associated in the machine equipment. And psychological factors are primarily assessed through a survey of residents and professionals.
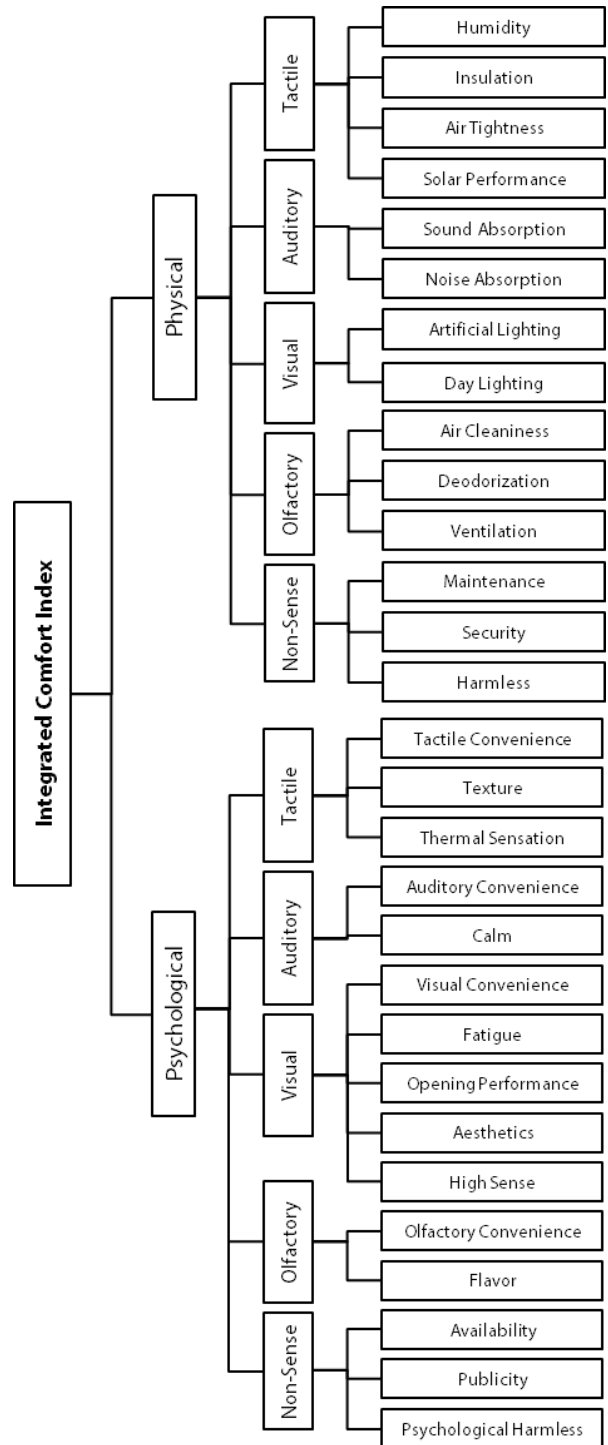
Fig. 3 Diagram for comfort taxonomy

Qualitative factors from the residents could also be examined by Scheffe analysis simultaneously. The Scheffe analysis is normally used with unequal sample sizes, and its critical value is the degrees of freedom for a variety of opinions that can be different badly each other among residents with possibly modifiable answers for environmental comfort in the same condition by the same routine.
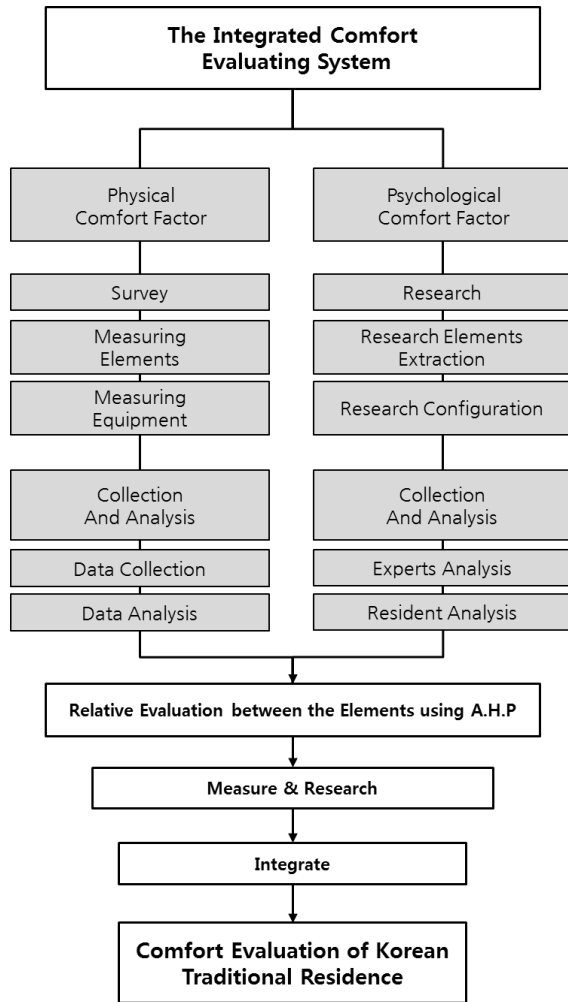
Fig. 4 Process of integrative comfort analysis

Then, measured physical and psychological factors were calculated according to the relative importance and by integrating the physical and psychological factors to calculate the overall comfort.

III. PSYCHOLOGICAL COMFORT FACTORS OF HANOK

A. Value and Psychological Factors of Hanok

Because Hanok has a wide range of values, evaluating by way of traditional approaches is difficult to obtain accurate results. To resolve this problem, this study proposes a new evaluation index for Hanok.

Many references were reviewed, and as a result, it was turned out that Hanok has many advantages and benefits that have close relationships with qualitative comfort factors. Hanok has some great features; first, it provides psychological comfort and stability through the connection of natural environment. This is a great advantage for modernized people who increasingly want to see through the intimacy with nature. Second, traditional windows, doors, structures and roof systems show the aesthetics of the building. Third, the traditional form of floor heating system (Ondol) is efficient. Ondol normally provides a thermal sensation and satisfactory

warmth to the residents. Finally, the whole index for comfort factors of Hanok has been investigated and organized with modern vocabularies as follows.
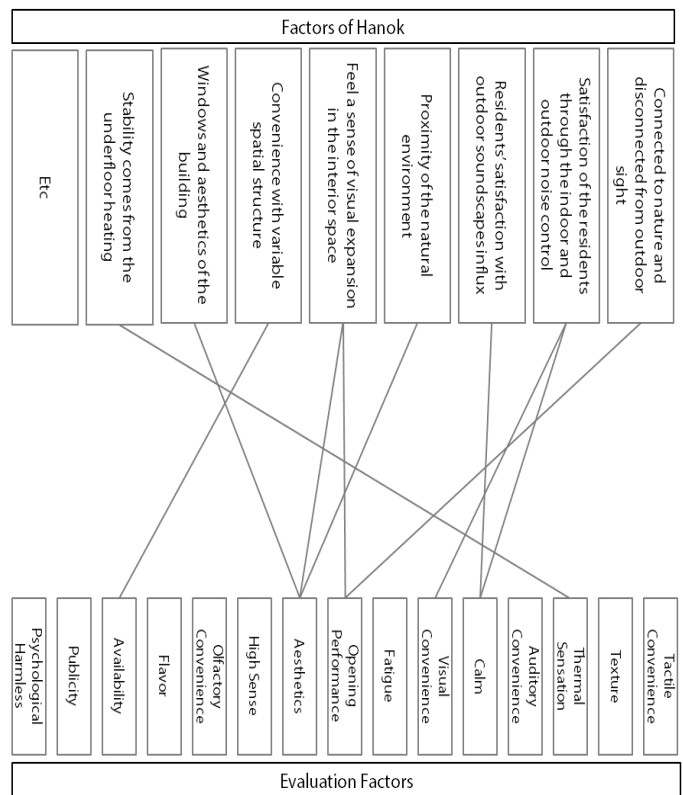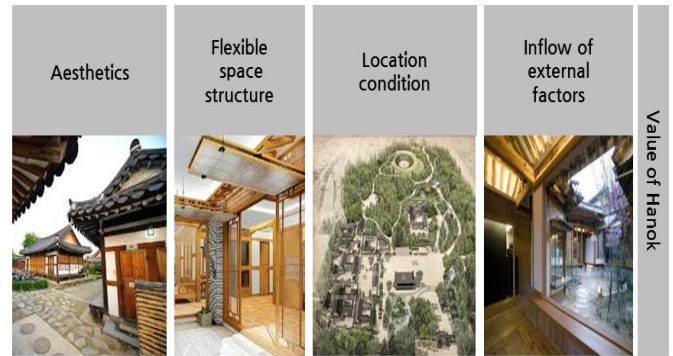

Fig. 5 Combination of the evaluation factors of Hanok

B. Vocabulary Reorganization of the Combined Evaluation Factors

The vocabulary of a comprehensive evaluation factors were reconstructed. This allows professionals and residents to grasp the meaning of comfort factors and get accurate surveys. Vocabularies found by assessment are as the following

- **Thermal sensation:** A thermal sensation felt by occupants in the room, the amount of clothing, and the parameters of metabolism, temperature, refers to the result, including the moisture MRT value.

- **Aesthetics:** Within the building as a traditional construction, says the aesthetics of the psychological satisfaction that comes from the outside of the building itself.
- **Visual Fatigue:** Proper combination of artificial and natural light considering the appropriate brightness distribution. Refers to the visual satisfaction felt by the installation location.
- **Availability:** Refers to the satisfaction use in everyday life though the appropriate design of such a public corridor, flexible space structure and door.
- **Psychological Harmless:** Refers to the psychological satisfaction of residents appears when using eco-friendly materials.

C. Weight Set Using AHP

Through the above process, the fill-out questionnaire and survey were selected by a representative expert. Selected experts are composed of researchers, professors and practitioners in the field of architecture. Then, this study utilizes the AHP (Analytic Hierarchy Process) to determine the weights of qualitative elements. Through this process, the weights between the elements could be set. Weights found by analysis are as the following:

TABLE I
SURVEY EXAMPLE FOR WEIGHT SET USING AHP

Pair-wise Comparison of Psychological Comfort Factors				
Factor A	*Importance*	*Equality*	*Importance*	*Factor B*
Tactile	5			Auditory
Tactile	3			Visual
Tactile	7			Olfactory
Tactile		1		Non-Sense
Auditory			3	Visual
Auditory		1		Olfactory
Auditory			5	Non-Sense
Visual	3			Olfactory
Visual			3	Non-Sense
Olfactory			7	Non-Sense

TABLE II
Weight Sets Obtained By Ahp

	Weight Results of Psychological Comfort Factors		
Factors	*Factor Name*	*Weight in Group (%)*	*Final Weight (%)*
Tactile	Tactile Convenience	30.90	6.89
	Texture	27.18	6.06
	Thermal Sensation	41.91	9.35
Auditory	Auditory Convenience	38.92	16.02
	Calm	61.08	9.79
Visual	Visual Convenience	16.25	5.38
	Fatigue	16.96	5.61
	Opening Performance	22.41	7.41
	Aesthetics	27.88	9.23
	High Sense	16.50	5.46
Olfactory	Olfactory Convenience	38.45	6.30
	Flavor	61.55	10.10
Non-Sense	Availability	46.38	5.65
	Publicity	23.69	2.88
-	-	-	99.9

By the weighted Analysis, it was possible to identify the important psychological comfort factor in the expert, professor group. Auditory convenience showed the highest result, followed by flavor, calm, thermal sensation, aesthetics

IV. CONCLUSION

The purpose of this study is to suggest a new comfort evaluation method that targets the Hanok and to propose the new way of Hanok assessment system. Most of the comfort assessment tends to be performed by only quantitative factors and to resolve this problem, relative factors have been analyzed by qualitative evaluation and a method of integrated evaluation has been suggested. Weight for comfort factors were finally established as shown in Table 2, when the survey conducted and qualitative part of the comfort could be assessed by residents.

After measuring physical comfort elements with the respective equipment, psychological comfort factors are analyzed through questionnaires. Then, integrated comfort scores have been derived from the weights and finally obtained.
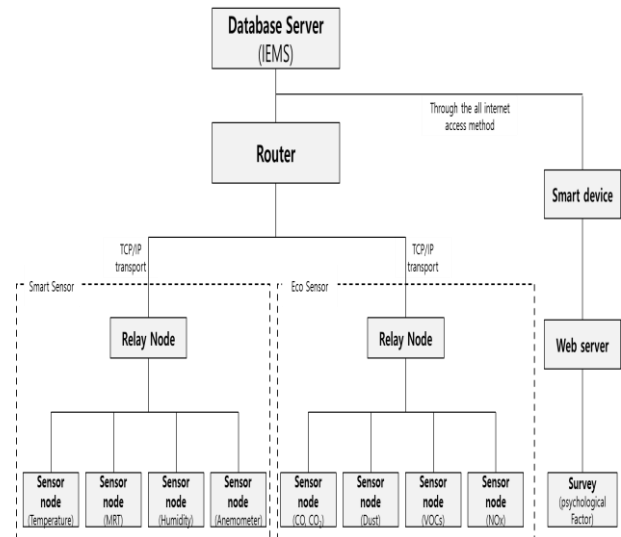

Fig. 6 Composition of intelligent evaluation for Hanok

As a result, newly suggested comfort evaluation method is expected to insure high efficiency. The proposed system includes qualitative factors that would show more accurate results. It was turned that the result showed satisfactory records towards the needs of the residents than ever before.

As ongoing research issue, comparison between Hanok and modern residence would be accomplished using suggested persuasive comfort performance indexes in near future

REFERENCES

[1] S. Baek and K. Ahn, "An Establishment of the Evaluation System of Hanok Residence in Seoul," Journal of Architectural Institute of Korea, Vol. 25, No. 5, May 2009, pp. 223-230.

[2]   S. Jung and J. Seo, "A Study on the Visual Characteristics of New Material for Emotional Housing Space Design," Journal of Korean Housing Association, Vol. 23, No. 3, Mar. 2012, pp. 71-78.
http://dx.doi.org/10.6107/JKHA.2012.23.3.071

[3]   S. Han, O. Im, M. Lee and D. Cheon, "A Study on the Establishment of an Evaluation System for Integrative Comfort," Journal of Korean Housing Association, Vol. 24, No. 6, Jun. 2013, pp. 27-35.
http://dx.doi.org/10.6107/JKHA.2013.24.3.027

[4]   T. Kim, K. Kim, S. Kim and S. Han, "A Composition of Monitoring System for Environmental Comfort Performance of Korean Traditional Residence," in Proceedings of the Second International Conference on Advances in Computing, Communication and Information Technology, Nov. 2014, pp. 169-173.

[5]   Y. Kwon, "A Consumer Research for NEO-Hanok Maeul, Korean Traditional Style Village," Journal of Architectural Institute of Korea, vol. 26, no. 11, Nov. 2011, pp. 97-106.

[6]   E. Chan, K. S. Lam and W. Wong, "Evaluation on Indoor Environment Quality of Dense Urban Residential Buildings," Journal of Facilities Management, Vol. 6, No. 4, Dec. 2008, pp. 245-265.
http://dx.doi.org/10.1108/14725960810908127

[7]   S. Min and T. Kim, "A Study on the Attractive Items of Hanok in Urban Area focused on Preceding Studies," Journal of Korean Institute of Rural Architecture, vol. 14, no. 3, Aug. 2012, pp. 61-68.

[8]   S. Han and S. Oh, "A Study on the Implementation of Ubiquitous Technology for Residential Space," Journal of the Korean Solar Energy Society, Vol. 27, No. 4, Dec. 2007, pp. 147-155.

[9]   S. Kim, K. Kim, J. Park and S. Han, "A Process of Value Assessment for Building Components of Hanok Residence," in Proceedings of the Second International Conference on Advances in Computing, Communication and Information Technology, Nov. 2014, pp. 164-168.

[10] C. Lee and G. Jeong, "An Analytic Hierarchy Process based Decision Support System for Selecting Foundation Practice," Journal of Korean Institute of Construction management, Vol. 13, No. 1, Feb. 2012, pp. 129-139.

[11] N. Schwertman and N. Carter, "A More Practical Scheffé-type Multiple Comparison Procedure for Commonly Encountered Numbers of Comparisons," Journal of Statistical Computation and Simulation, Vol. 53, No. 3-4, 1995, pp. 181-196.
http://dx.doi.org/10.1080/00949659508811705

[12] S. Park, "A Study on the application of the Environmental Control Methods Expression in Korean Traditional Residence to Korean Modern Architecture," Master's Thesis, Korea University, 2011.