

Comparison on the lighting environment of living room between China and Korea

: Comparative study on the lighting environment of houses in Korea and China 1

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Abstract

To compare the lighting environment of the living rooms in the apartments in Korea and China, this research conducted a study of the current status, targeting 79 households in Korea and 68 households in China. The results are the following. First, the two nations use mostly fluorescent light as the general lighting for the living room. China, in particular, share of not using the local lighting is very high. Secondly, levels of illumination was measured. The result demonstrates that the brightness of the lighting is higher in Korea compared to China while China demonstrates higher uniformity ratio for the levels of illumination compared to Korea. However, levels of illumination in general are very low in China. Thus, it cannot be concluded that China offers favorable lighting environment. Third, study on the degree of living room lighting's brightness and satisfaction level demonstrates that they are both average in Korea and China. As for the important points for the house lighting, most Koreans cited 'brightness of the lighting' while most Chinese said 'ease of maneuvering'.

Key Words : Living Room, Korea And China, Lighting Environment

1. Introduction

Residential space is what all of us experience, and it is the representative indoor space where we spend considerable portion of our time. Likewise, role of artificial illumination is crucial. Living room among the residential spaces is the space where all the activities of every day life take place besides

the sanitary acts. Thus, this is a place where the planning for adaptive lighting is needed. In other words, levels of illumination required for entertainment, family circle, reading, make-up, sewing, handicraft and all other every day life activities are different. Accordingly, specific standard for levels of illumination that suit diverse every day life acts is required. Thus, adaptive illumination plan that can modify lighting environment according to need is required.

China is an Asian nation like Korea. After the diplomatic ties were formed, entry of the Korean companies into China is increasing. Going forth, demand for the investment to construct housing is

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likely to increase significantly as well¹⁾.

To this, to ensure successful entry of the Korean illumination designers into China, it is necessary to identify the current status of the Chinese lighting environment and the Chinese people's perception of the lighting environment. Accordingly, the researchers conducted a study on the current status pertaining to the lighting environment of the houses in Korea and China. This paper focuses on the lighting environment of the living room where the family members spend most of their time.

2. Research method

Table 1 is on the overview of the current status pertaining to the living room's lighting environment.

Table 1. Experimental conditions

Investigation	China 65 households, Korea 79 households
Research time	After sunset (6 after that)
Measuring tools	Minolta digital illuminometer T-1, Measuring tape
Research topics	① Living room space size
	② Type and number of light sources
	③ Dominance color
	④ With living room lighting lucidity degree lighting environmental satisfaction
	⑤ Lighting use method of living room
	⑥ The interior lighting environmental problems
	⑦ Internal illumination(9 point measurement)
Research methods	Research of visit actual survey
Investigate period	China : From January 18, 2009 to February 20, 2009
	Korea : From May 2, 2008 to June 15, 2008

1) Kim, Tae-Hwang, Kang Min-Seok, Change in the Chinese Construction Market Environment, and Entry Strategy, Construction & Economy Research Institute of Korea, 2001. 6. p.1

This research's research subjects are the 79 households that reside in the apartments located in Daegu and Northern Gyeongsang Province in case of Korea. In case of China, the subjects are 68 households residing in apartments located in Shenyang.

Daegu, the city where the research subjects reside is one of the seven leading cities in Korea while Shenyang is an heavy industry geared city with 5th largest land mass in China. These cities were selected for the study since they take up similar position in the respective nations in terms of size.

Moreover, only the apartments with specific specifications and that are sold in the market were selected for the study since lighting environment differs depending on the type of housing.

The research was conducted from May to June 2008 in case of Korea. In China, the study was conducted from January to February 2009.

Table 2. General facts of the surveyed subject

Classification	Region	N(%)	
		Korea	China
Gender	Man	20(25.3)	36(52.9)
	Woman	59(74.7)	32(47.1)
Age (years)	20 or less	7(8.9)	3(4.4)
	21~30	29(36.7)	22(32.4)
	31~40	-	14(20.6)
	41~50	2(2.5)	22(32.4)
	51~60	-	7(10.3)
	More than 61	41(51.9)	-
	M(SD)	47.78(24.48)	37.54(10.65)
Dwelling year possibility (year)	1 or less	4(5.1)	4(5.9)
	2~5	23(29.1)	10(14.7)
	5~7	15(19.0)	9(13.2)
	7~10	15(19.0)	10(14.7)
	More than 10	21(26.6)	35(51.5)
M(SD)	3.33(1.30)	3.91(1.34)	

As for the research method, the target houses were visited in person as the sun set to conduct interview and actual survey.

The research categories are shown on Table 1. The research results were analyzed using the SPSS 17.0 program to identify frequency and so forth using cross tabulation analysis etc.

General matters pertaining to the research subjects are shown on Table 2.

3. Research results and analysis

3.1 General matters

Table 3 demonstrates the size of living room and total size of houses in Korea and China.

As for the houses' total size, most of the Korean houses (40.3[%]) measure 99~131[m²] while the average is 126.26[m²]. In case of China, 66~98m² took up the most with 55.2[%] while the average is 94.13[m²]. In other words, Korean houses studied are bigger, and the difference in size is significant(p<.001).

Table 3. Whole size and living room size of house(m²)

		N(%)	
	Region	Korea	China
Whole size of house ***	66 or less	-	7(10.4)
	66~98	18(26.9)	37(55.2)
	99~131	27(40.3)	18(26.5)
	132~164	13(19.4)	4(5.9)
	More than 165	9(11.4)	1(1.5)
	M(SD)	126.3(35.01)	94.1(26.40)
Living room size	10 or less	3(3.8)	4(8.7)
	11~20	29(36.7)	20(43.5)
	21~30	22(27.8)	16(34.8)
	31~40	3(3.8)	5(10.9)
	More than 40	3(3.8)	1(2.2)
	M(SD)	20.2(8.99)	20.7(9.58)

Moreover, living room's size is similar for both Korea and China with most measuring 11~20[m²] while average size is similar. Likewise, there is no significant difference.

Table 4 demonstrates the dominant colors for the living rooms in Korea and China.

In case of living room floor, Korean houses tend to have brown and yellow floors, while the floors in China are mostly ivory colored. Moreover, both Korea and China have mostly white ceilings and walls.

3.2 Snapshot of the living room's lighting environment

Table 4. Living room space dominance color

		N(%)	
Classification	Region	Korea	China
Floors	Brown	44(56.4)	17(25.1)
	Ivory	6(7.7)	19(28.0)
	Yellow	16(20.5)	14(20.5)
	Gray	2(2.6)	5(7.4)
	White	7(9.0)	7(10.3)
	Red	-	4(5.9)
	Other	3(3.9)	2(3.0)
Ceilings	Ivory	31(39.7)	-
	White	42(53.8)	68(100.0)
	Other	5(6.5)	-
Walls	Yellow	1(1.3)	8(11.7)
	Red	3(3.8)	-
	Ivory	33(42.3)	9(13.2)
	White	36(46.2)	48(70.6)
	Pink	2(2.6)	2(3.0)
	Other	3(3.9)	1(1.5)

Table 5 demonstrates types of source of light and number for the living rooms.

Over 70[%] of the houses in Korea(73.1[%]) and China(73.5[%]) do not use incandescent lamp. In case of fluorescent light, over 90[%] of

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Korea(92.3[%]) and China(92.6[%]) use it. Thus, it is possible to see that both Korea and China use mostly fluorescent light as the source of light in the living rooms.

Table 5. Type of source of light and number for the living rooms

Region		N(%)	
		Korea	China
Incandescent lamp	Is not	57(73.1)	50(73.5)
	1~2	8(10.3)	10(14.7)
	3~4	7(8.9)	5(7.3)
	More than 5	6(7.6)	3(4.4)
	M(SD)	0.86(1.70)	0.82(2.21)
Fluorescent light***	Is not	6(7.7)	5(7.4)
	1~2	38(48.7)	56(82.3)
	3~4	23(29.5)	6(8.9)
	More than 5	11(14.1)	1(1.5)
	M(SD)	2.64(2.27)	1.35(1.48)
Halogen***	Is not	67(85.9)	36(52.9)
	1~2	6(7.6)	7(10.3)
	3~4	3(3.9)	3(4.4)
	More than 5	2(2.6)	22(32.4)
	M(SD)	0.37(1.07)	3.03(3.99)
Stand	Is not	77(98.7)	65(95.6)
	More than 1	1(1.3)	3(4.4)

The average number of fluorescent light used is 2.64 for Korea and 1.35 for China, which demonstrates that greater number of fluorescent light is used in Korea than China for general lighting($p<.001$).

In case of halogen, over 80[%] of the Korean households do not use it, but the shares of those households in China that use and do not use it are similar, which is different from Korea. As for the average number of halogen lamps used, it is 0.37 for Korea and 3.03 for China in average, which demonstrates that halogen is used more in China than Korea ($p<.001$).

As for the stand, both Korea and China do not

use it in the living room.

The above mentioned results show that both Korea and China rarely use incandescent lamp and stand in the living room while the two nations use mostly fluorescent light in the living room. However, China uses more halogen than Korea.

Table 6. Lighting use method of living room

Region		N(%)	
		Korea	China
General lighting		27(37.5)	44(71.0)
General+Local		45(62.5)	18(29.0)

When the way that the two nations use lighting in the living room is examined (Table 6), 62.5[%] of the Korean households use both general lighting and local lighting while 71.0[%] of the households in China use only general lighting.

As for the result of measuring levels of illumination for the living rooms in Korea and China using nine points, it is shown on Table 7 while Table 8, 9 shows the KS illumination standard and measured average illumination ratio.

When the living room's average levels of illumination is examined, Korea is 204.8[lx] while China is 96.7[lx], which demonstrates that the brightness of the lighting in Korea is at least twice that of China, which is significantly different($p<.01$). In case of Korea, average levels of illumination increased due to the five households that use at least 400[lx]. When these households are excluded, the figure decreases to 149.3[lx], which is not even comparable to the minimum level of illumination when it comes to entertainment and family circle. In other words, Korea manifests significant standard deviation when it comes to the average levels of illumination's standard deviation while China manifests low average levels of illumination.

Table 7. Average illumination and uniformity of living room(lx)

Classification	Region	N(%)	
		Korea	China
Average illuminations **(lx)	100 or less	24(31.6)	41(60.3)
	101~200	30(39.5)	26(38.2)
	201~300	9(11.8)	1(1.5)
	301~400	8(10.5)	-
	401~500	1(1.3)	-
	501~600	1(1.3)	-
	More than 601	3(3.8)	-
	M(SD)	204.8(258.15)	96.7(41.43)
Uniformity ***(%)	20 or less	40(51.3)	13(19.1)
	21~40	24(30.8)	33(48.5)
	41~60	12(15.2)	13(19.1)
	More than 61	2(2.5)	9(13.2)
		M(SD)	24.47(0.15)

Table 8. KS illumination standard and China illumination standard

Life act	KS illumination standard			China illumination standard	
	Mini mum	Stan dard	Maxi mum	Mini mum	Maxi mum
General illuminations	30	40	60	80	100
Recreation · Harmony	150	200	300		
Reading · Make-up	300	400	600		
Handicraft · Sewing	600	1000	1500		

When the brightness of the lighting in the living rooms in Korea and China is examined based on the KS illumination standard, the two nations satisfy the general illumination standard (standard 40[lx]), but there are many instances in which the levels of illumination do not meet the standard when examined by specific every day activity. In other words, Korea satisfies standard levels of illumination(200[lx]) for the entertainment and family circle when it comes to the general

illumination's standard levels of illumination (40[lx]), but it fell short of satisfying the standard for reading or make-up (standard levels of illumination(400[lx])) with 51.2[%]. For the sewing or handicraft, Korea stopped at 20.5[%] of the standard levels of illumination(1000[lx]). Likewise, it is possible to see that the brightness for the living room's lighting environment where diverse every day life acts take place is rather lacking.

Table 9. KS illumination standard and measurement average illumination ratio

Life act	KS illumination standard			Average illuminations (lx)		Average illuminations / Reference illuminations × 100(%)					
	Mini mum	Stan dard	Maxi mum	Korea	China	Korea			China		
						Mini mum	Stan dard	Maxi mum	Mini mum	Stan dard	Maxi mum
General illuminations	30	40	60	204.8	96.7	Satisfy	Satisfy	Satisfy	Satisfy	Satisfy	Satisfy
Recreation · Harmony	150	200	300			Satisfy	Satisfy	68.3	64.5	48.4	32.2
Reading · Make-up	300	400	600			68.3	51.2	34.1	32.2	24.2	16.1
Handicraft · Sewing	600	1000	1500			34.1	20.5	13.7	16.1	9.7	6.4

Table 10. With living room illumination lucidity degree illumination environmental satisfaction

Classification	Region	N(%)	
		Korea	China
Brightness of the lighting	Very dark	-	1(1.5)
	Is dark a little	14(17.7)	16(23.5)
	Is a usual	34(43.0)	33(48.5)
	Dawns a little	25(31.6)	17(25.0)
	Very bright	6(7.6)	1(1.5)
	M(SD)	3.29(0.85)	3.01(0.78)
Satisfaction level	Very dissatisfied	1(1.3)	1(1.5)
	A little unsatisfactoriness	8(10.1)	12(17.6)
	Is a usual	32(40.5)	27(39.7)

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Classification	Region	Korea	China
	A little satisfaction	27(34.2)	24(35.3)
	Very satisfied	11(13.9)	4(5.9)
	M(SD)	3.49(0.90)	3.26(0.87)

Living room's general illumination²⁾ from the viewpoint of China's levels of illumination is specified as 100~80[lx]. Average levels of illumination measured in this research is 96.7[lx], which satisfies the standard. However, when the pattern of using living room where diverse activities take place is factored in, it is necessary to improve brightness. In particular, share of using the local lighting is very low. Likewise, it is necessary to install illumination devices or facilities so that the levels of illumination can be adjusted according to the every day life pattern.

When examined according to the uniformity ratio for the levels of illumination³⁾, over 60 indicates outstanding, over 30 indicates favorable, over 20 indicates average and less than 5 indicates defective state. In case of Korea, it is 24.47[%] while China records 36.25[%], which is favorable. In case of China, however, overall levels of illumination are very low. Thus, it is difficult to conclude that the environment is a favorable one despite favorable uniformity ratio for the levels of illumination.

3.3 Awareness of the living room's lighting environment

Table 10 indicates the result of the research on

- 2) Wang, Gae-Won, Standard for the Construction Illumination Design, 2004.
- 3) Kim, Hyun-Ji, An, Ok-Hee, Contemplation on the calculation method for the indoor space's artificial illumination uniformity ratio for the levels of illumination, (Korean Institute of Illuminating and Electrical Installation Engineers), collection of journals Volume 13, edition 2, pp. 7~11. 1999. 5

the brightness of the lighting in the living rooms in Korea and China, and satisfaction level of the lighting environment.

Five-point Likert-type scale was used to study satisfaction level of the lighting environment with one point indicating 'very dark' while five points indicating 'very bright'. As for the awareness on the brightness of the lighting, one point indicates 'very dissatisfied' while five points indicates 'very satisfied'. Then, satisfaction level of the lighting environment was studied, which shows that both Koreans(3.29 points) and China(3.01 points) feel above average brightness. Thus, both Korea(3.49 points) and China(3.26 points) manifest above average satisfaction level when it comes to the satisfaction level of the lighting environment.

In case of China, Chinese people are not feeling that the amount of light is lacking despite the fact that the levels of illumination are very poor. In case of Korea, residents' satisfaction level on the degree of brightness was always above average, which may be because of the adaptation to the environment where they live in, and due to the lack of the target of comparison. In other words, even when residents answer that they are satisfied with the lighting environment, there are instances in which the lighting environment is not favorable. Thus, it is necessary to pay attention to this issue when analyzing the results of the current state analysis.

Table 11. The important points for the house lighting and problems

Classification	Region	N(%)	
		Korea	China
The important points for the house lighting	Brightness of the lighting	37(47.5)	10(14.7)
	Management of illumination	9(11.5)	10(14.7)
	Effectiveness of	21(26.9)	13(19.1)

Classification	Region	Korea	China
	the lighting		
	Safety	6(7.7)	12(17.6)
Problems	Ease of maneuvering	5(6.4)	23(33.8)
	Being dazzling	10(12.8)	4(5.9)
	Brightness of the lighting	21(26.9)	21(30.9)
	Shadow	5(6.4)	4(5.9)
	Effectiveness	10(12.8)	13(19.1)
	Management of illumination	27(34.6)	24(35.3)
	Other	5(6.4)	2(2.9)

Table 11 demonstrates the important points for the house lighting and problems.

In case of Korea when it comes to the important points for the house lighting, they are brightness of the lighting(46.2[%]), illumination's effectiveness(26.9[%]) and management of illumination(11.5[%]) in the order mentioned. In case of China, they were ease of maneuvering(33.8[%]), illumination's effectiveness (19.1[%]) and safety (17.6[%]) in the order listed. This shows that Korea and China have different priorities when it comes to the important requirements of lighting. Here, it is important to notice that Korea considers amount of light important while China prioritizes management level aspects such as ease of use and safety instead of the quality level issues such as the amount of light.

As for the problems pertaining to the lighting of the houses, both Korea and China prioritize 'management of illumination' and 'brightness of the lighting' in the order listed.

Accordingly, it is necessary to plan so that in Korea, illumination can be managed after securing sufficient amount of light. In case of China, it is necessary to raise awareness that securing sufficient amount is required, and to plan so that

sufficient amount of light can be secured at the places that are required by using local lighting and so forth, and to design for illumination so that it is easy to use and free from safety issued.

4. Conclusion

This research targeted the living rooms in Korea and China to analyze the current status pertaining to the lighting environment for comparative analysis.

The results are as follows.

First, in terms of the size of the houses, Koreans live in slightly larger houses compared to the Chinese while there is no difference in the size of the living rooms.

As for the main colors used for the living rooms, Koreans use mostly brown and yellow for the floor, while Chinese use mostly ivory and brown. In case of the ceiling and wall, both nations use mostly white.

Secondly, both Korea and China use fluorescent light for the living room's general lighting. In case of China, share of the halogen is high, while share of local lighting is very low.

Moreover, measurement of the levels of illumination shows that Korea enjoys at least twice the brightness of the lighting compared to China. As for the uniformity ratio for the levels of illumination, China manifests more favorable condition than Korea, but in case of China, overall levels of illumination are very low, which makes it difficult to conclude that the lighting environment is favorable.

Third, both Korea and China manifest above average brightness of the living room and satisfaction level. As for the important points for the house lighting, Korea cites mostly the 'brightness of the lighting' while China cites mostly 'ease of maneuvering'. Moreover, as for the

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problems of lighting, both Korea and China cite 'management of illumination' and 'brightness of the lighting'.

When the current status pertaining to the illumination in the living rooms in Korea and China is compared, the two nations fail to counter-measure the changes in the living rooms where diverse activities take place. In case of Korea, quality level improvement such as dimmer facility that can use local lighting or counter-measure the changes taking place in terms of levels of illumination is required. In case of China, securing of sufficient levels of illumination needed for various every life activities is urgently called for.

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