

## AESTHETIC FACTOR ANALYSIS OF INTERIOR SPACE

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### ABSTRACT

This is an empirical aesthetics study of the man-made interior environment. The purpose is to explore the aesthetic factors of interior environment that contribute to the perception of a beautiful experience in the systematic approaches; as well as differences from individual aesthetic response. This study used real photos of interiors as its tool via correlation analysis to analyze. With the same sampling method, this study conducted two questionnaire surveys in 2014 and 2015 respectively. Participants were design major students and non-design major students from three universities. The valid collected questionnaires were 1176. Ten aesthetic factors regarding interior environment were extracted from SPSS 18.0 analysis. Through different times and participants, the two survey data showed consistency and stability in aesthetic factor structure after cross-validation. These factors cumulated 55.03% of explained variance. Design major students and non-design major students were significantly different on nine aesthetic factors, while gender only showed significance on two factors.

**KEYWORDS:** Aesthetic Factor, Aesthetic Response, Interior Design, Correlation Analysis

### INTRODUCTION

Human possess a natural instinct to pursuit beauty. Artists and designers strive to keep people satisfied with various needs of beauty and aesthetics. With different preferences and individual subjectivities, answers to the definition of beauty can be various. Research studies have long been hoping to find out more regarding aesthetics in a systematic and organized approach.

In 1750, A. Baumgarten created the vocabulary of “aesthetics” from the Greek word “aisthetikos” (which refers to perception, of feelings in particular) to represent a nature science that aims at reality based on aesthetics, which is totally different from logic (Schmitt & Simonson, 1997). In ancient times, the focus of aesthetics study merely rests upon perception of poetry, painting, and sculpture. G. W. F. Hegel (1770-1831) even limits aesthetics only to fine arts. Nowadays, the meaning and scope of aesthetics are expanding. From philosophers, artists, psychologists, behavior scientists, marketing experts, to environmental designers, including urban, architecture, landscape, and interior, more and more professionals are devoted into aesthetics. Although diverse viewpoints and opinions surge, two major research focuses remain as its central core. 1. Identify and understand elements that trigger aesthetic (or pleasure) perception. 2. Recognize human nature of creating and appreciating beauty (Lang, 1987: 181). Research focuses of the two topics are distinctly different from each other. The first one refers to research on process of forming perception, recognition, and attitude which concentrates on empirical theory with psychological attributes. Aesthetics research of this type is classified as empirical aesthetics. The second one mainly includes research of aesthetics philosophy and creation process that focuses on normative theory with metaphysic and psychological analysis attributes. This type, on the other hand, is classified as

analytical aesthetics or speculative aesthetics. Past research relates to environmental aesthetics is mainly empirical aesthetics.

When it comes to empirical aesthetics research regarding the environment, most research studies would like to find out which environmental factors provide aesthetic perception. Correlation analysis is the most commonly used to examine relations between two or more variables (Lang, 1987: 184). Correlation analysis mainly uses object format or structure (aesthetic factor) as independent variable, while using human subjective perception of format or structure (aesthetic response) as dependent variable. Individual attribute is used as observed variable. Abundant research results can be found easily. Unfortunately, most research simply focus on natural environment or man-made exterior environment, such as urban, landscape, and buildings. Research regarding interior environment is relatively rare. Moreover, empirical research results show that professional designers tend to have preference distinctively different from the general public and often misjudge their preference (Devlin & Nasar, 1989; Groat, 1982; Nasar, 1989; Nasar& Kang, 1989).

Interior design is a key part of environmental design. Though it is closely connected to architectural design, the work content during design process is extremely different; such as design criteria and prominence, subject and scope, design scale, detail design, material forms, color arrangement, and visual effect, etc. (Chuang and Jan, 2001). Architectures are presented to people often by its exterior appearance from afar, however, the experience with interior design is totally opposite to it. Therefore, aesthetic factor and aesthetic response to architectures and interior environment should certainly be different. The existing research studies regarding man-made environment aesthetics mainly concentrate on building exterior, unfortunately, topics regarding interior environment are extremely rare to find. With limited empirical study results, interior space users' aesthetic preferences are "taken for granted" by most interior designers based on their subjective experience or wild guess. More validations are needed to ensure those results match users' aesthetic demands.

Therefore, this study hopes to find out (1) aesthetics factors that cause aesthetics response from the interior design viewpoint based on man-made interior environment, and (2) preference difference towards these aesthetic factors among design major and non-design major students.

## RELATIVE LITERATURES

Relative literatures regarding empirical aesthetics of interior environment mainly include interior environment, aesthetic factor, aesthetic response, and formal aesthetics. Further information is as followed.

- Interior environment: it represents the physical environment that interior designers work in which includes spatial planning (pattern and proportion), furniture and decoration, wall and ceiling design, texture and color, lighting equipment and effect, window and door, etc. Exterior and main structure of building, clothing, and daily grocery are excluded.
- Aesthetic factors: components of the physical environment that cause aesthetic response mainly through human visual perception. Backer (1987) classified these components into three groups: A. Ambient factor, i.e. temperature, humidity, air quality, noise, and scent. B. Social factor refers to behavior, action, and number of users in the environment. C. Design factor consists of functional factor and aesthetic factor. Aesthetic factor includes building, color, ratio, material, texture, style, format, and accessory. Aesthetic factor in this study is based on Baker's definition, since the research scope is limited to interior environment, building is excluded.

- Aesthetic response: it refers to wonderful mentally, physically, and behaviorally reactions result from environmental aesthetic factors. Nasar (1997) argued that aesthetic response consists of affective appraisal, physiological response, and behavior. Aesthetics originates from human, environment, and its interaction, while aesthetic response and building physical attribute have a probabilistic relation. Certain building physical attribute might trigger certain aesthetic response. Cognition plays a key intervening variable during its process. Aesthetic response varies from personality, social and cultural experience, intention, expectation, and subjective and objective viewpoints with all different probabilities. Nasar's probabilistic framework for aesthetics clearly explained the relation between aesthetic factor and aesthetic response based on interactionalism. Because interior environment is included in building, interior environment attribute is also a part of building attribute as well; this framework is suitable for this study.
- Formal aesthetics: also known as structural aesthetics based on Gestalt psychology which stresses on relation between aesthetic experience and object form or structure itself. Variables of form or structure include, shape, proportion, rhythm, ratio, complexity degree, color, lighting, and shade (Lang, 1987), spatial syntax and spatial relation system (Groat & Després, 1991), complexity, incompatibility, ambiguity, marvel, novelty, and order (Wohlwill, 1976). These variables were classified as three categories by Nasar (1997), (A) Complexity, i.e. visual richness, decoration, and information ratio. (B) Order, i.e. unity, order, and clarity. (C) Spatial variable, i.e. openness, spatial arrangement, mystery.

## RESEARCH METHODS

Data collecting is used to collect and understand relative empirical aesthetics literature review and research results which can be used as the basis of this study. In order to increase content validity of aesthetic factor, expert meeting helps establish an initial survey tool, i.e. chart; which is conducted after pilot test. The main purpose of this type of study is to find out the correlation among individual attribute, aesthetic factor, and aesthetics response in man-made interior environment and tries to establish a set of behavior regulations relates to aesthetic response. Therefore, this study adopts correlation analysis to analyze test results from "man-made interior environment aesthetic factor chart" and "man-made interior environment aesthetic response chart".

With the purpose of realizing the possible differences between professional interior designers and the general public, this study used stratified sampling to sample its participants into the interior designer and the general public. According to Ghiselli et al., (1981) the amount of sample should be no less than 300, hence, the valid samples for each group remain at the minimum of 300.

Though plan, elevation, perspective view, picture, model, or slide display can be used as survey tool for environmental aesthetics, majority of foreign studies indicated that participant's response identically to the colored slides and pictures displayed as they were on site (Hershberger & Cass, 1974; Kaplan & Kaplan, 1989; Oostendorp, 1978; Seaton & Collins, 1970). This study adopts colored pictures that remade from magazines as its survey tool. The contents of pictures were drafted based on literature analysis and finalized after expert meeting and pilot test.

Followings are the research steps.

- According to literature reviews, 10 key elements to interior environment were listed as follow, color, lighting, style, shape, proportion, rhythm, material, texture, furniture, and spatial composition.
- Two interior design graduate students selected out 500 real scene colored photos from Interior Magazine issued from 2003 to 2012 based on the 10 elements, while two professional interior designers also picked out 383 photos on the equal criteria from the same magazines. 125 identical photos were selected in this step.
- 10 interior design college teachers were invited to select photos that best suit the 10 elements from the 125 photos. 40 photos were selected by more than six teachers in the end; the amounts of photos for each element were not evenly distributed. All 56 photos are numbered and categorized by alphabet, A for color, B for lighting, C for style, D for shape, E for proportion, F for rhythm, G for material, H for texture, I for furniture, and J for spatial composition. For instance, E7 represents the 7<sup>th</sup> photo under the category of proportion. A power point file consists of these 56 photos was displayed in class to test aesthetic response. Only numbers were shown during questionnaire display, without categories alphabets.
- The first questionnaire was conducted by class in 2014 to design major (DM) students (from Interior Design departments at Chung Yuan Christian University (CYCU) and Shu-Te University (STU), and Space Design Department at National Yunlin University of Science and Technology (YUNTECH)), and non-design major (NDM) students (from Civil Engineering and Industrial Engineering departments at CYCU and Recreation & Sport Management and Electrical Engineering department sat STU). The participating class was selected randomly from teachers that agreed to join in this survey. A brief instruction was given to the class before displaying all 56 photos with three seconds interval, so that participants would have a rough understanding and impression. Later, participants were asked to grade each photo subjectively with a 15 seconds interval. Likert scale was used to measure aesthetics level, from extremely attractive (5), attractive (4), neutral (3), unattractive (2), and extremely unattractive (1). Higher scores indicate more attractions to the participants. Questionnaires were collected immediately afterwards, with a total of 665 valid questionnaires.
- An initial analysis was conducted via SPSS 18.0 to examine the items and reliability of the survey tool. Regarding reliability evaluation, the survey tool (all 56 questions) showed an excellent internal consistency, with its Cronbach's  $\alpha$  reached.8772. Followed by factor analysis and orthogonal varimax rotation, 15 factors with eigen value higher than 1 were extracted, which could explain up to 53.03% of variance. However, the extracted factors were too many and too complex structurally, it was better to find a balance point between numbers of factors and overall explainable variance. According to results from item analysis, 16 questions with poor observation were deleted. Another analysis was conducted again to the rest 40 questions. A.8374 Cronbach's  $\alpha$  was finalized, reduced slightly by 0.0398; indicating a high reliability remained. As for factor analysis, results from KMO and Bartlett's test indicated KMO=.837, higher than 0.5 and close to 1. As well as the chi-square distribution was 6827.059 (DF=780),  $p=.000$  with significance. It pointed out those common factors in correlation matrix of population suitable for factor analysis. 10 factors with eigen value higher than 1 were extracted from the factor analysis using the abovementioned approach. These 10 factors could explain up to 55.03% of variance. This process helped reduce 28.6% (16/56) of questions in the survey tool. Though the overall explained variance merely dropped by 1.95%, the factors were decreased from 15 to 10. Therefore, question items were simplified, as

well as a better balance point between numbers of factors and overall explainable variance was found.

- In order to improve the examiner quality, LISREL 8.8 was applied to conduct goodness-of-fit index in Confirmatory Factor Analysis (CFA) for the survey model. Results of the test were  $\chi^2/df=3.18$  ( $\chi^2=2210.79$ ,  $DF=695$ ),  $GFI=0.86$ ,  $AGFI=0.83$ ,  $NFI=0.85$ ,  $NNFI=0.88$ ,  $CFI=0.89$ , and  $RMSEA=0.057$ , which failed to achieve the recommended value ( $\chi^2/df<3$ ,  $GFI>0.90$ ,  $NNFI>0.90$ , and  $CFI>0.90$ ) as Kline (1998, pp.127-131) suggested, indicating survey quality requires improvement. After reviewing factor loading in each potential factor, 10 questions with low factor loading were deleted. The survey was downsized to 30 questions.
- Another CFA was conducted again to the rest 30 questions. The goodness-of-fit index results were  $\chi^2/df=2.76$  ( $\chi^2=993.51$  ·  $df=360$ ),  $GFI=0.91$ ,  $AGFI=0.88$ ,  $NFI=0.88$ ,  $NNFI=0.91$ ,  $CFI=0.92$ , and  $RMSEA=0.051$ . All results showed good goodness of fit, indicating improved survey quality. Figure 1 showed the estimated standardized parameters. Final analysis was only made to these 30 questions in this study.
- Expert meeting was held with 10 experts with interior design master's degree, plus a minimum of seven years of interior design profession were invited to examine the 10 factors. They helped to interpret and define characteristics of photos from each factor.
- The same sampling was used in 2015 and another 511 participants were joined in to conduct cross-validation, a technique for estimating the performance of a predictive model. The basic model in Table 1 simply applied the 2014 sample to the 2015 sample, was the fundamental type model without setting any equal parameters. Model a adopted moderate replication strategy (MRS), setting the identical model and factor loading on both 2014 sample and 2015 sample. Model B adopted tight replication strategy (TRS), setting all model parameter estimations, including factor loading, covariance coefficient, and error term parameter on 2014 sample and 2015 sample all equal. Model A showed no significance, with  $\Delta d.f. = 20$  ·  $\Delta\chi^2=26.24$  ( $p>.05$ ). It pointed out that differences in-between were randomly triggered; indicating MRS of 2014 sample used on 2015 sample was supported. Model B showed significance, with  $\Delta d.f. = 105$  ·  $\Delta\chi^2=1353.04$  ( $p<.001$ ). It stated that the error term parameter did not justify demand of same setting, the TRS was not accomplished. Results from cross-validation matched MRS that provided evidences of partial cross-validation, while TRS was not fulfilled.

**Table 1: Cross-Validation of Aesthetic Factor Survey Model**

Model	$\chi^2$	d.f.	GFI	NFI	RMSE A	$\Delta\chi^2$	$\Delta d.f.$
Test sample (n=665)	760.29*	336	0.97	0.95	0.048	-	-
Validity sample(n=511)	805.51*	336	0.90	0.95	0.051	-	-
Fundamental Model <sup>a</sup>	2191.47*	720	0.86	0.89	0.059	-	-
Model A <sup>b</sup>	2217.71*	740	0.86	0.88	0.058	26.24	20
Model B <sup>c</sup>	3544.51*	825	0.82	0.83	0.075	1353.04*	105
Remarks:							
a. 2014 sample and 2015 sample in Fundamental Model use the same model structure, without setting any equal parameter.							
b. Model sets the equal factor loading.							
c. Model B sets the equal factor loading, factor covariance coefficient, and error term parameter.							
*p<.001							

## RESEARCH DATA ANALYSIS

According to the research design, this study conducted two questionnaire surveys, with the identical sampling method. 665 valid questionnaires were collected in 2014 for the first survey. The second survey collected 511 valid questionnaires in 2015. The total valid questionnaires were 1176. Followings were analysis of these two surveys.

### The First Survey

With a recall of valid 665 questionnaires, followings were basic background of the participants.

- Academic major: 326 DM students, and 339 NDM students (i.e. civil engineering, industrial engineering, sports and leisure, and electrical engineering, etc.)
- Gender: 327 males and 338 females.
- Grade: 126 freshmen, 152 sophomores, 206 juniors, and 181 seniors.

Followings are the Results of Questionnaire Analysis via SPSS 18.0

The aesthetic level average of each factors in a descending order were: (Table 2)

**Table 2: Ranking and Characteristics of Each Aesthetic Factor**

Ranking	Factor	Average *	Standard Deviation	Major characteristics
1	C	3.63	0.67	Natural lighting and visual penetration
2	B	3.35	0.65	Concise stripe, steady hue and conventional texture
3	A	3.32	0.65	Regular style and bright colors
4	E	3.31	0.77	Design-featured furniture and decoration
5	F	3.27	0.80	Dramatic lighting effect and cool-toned texture
6	G	3.15	0.73	Modest hue, style and lighting change
7	I	2.89	0.60	Pure background sets off a lively and diverse furnishings
8	J	2.82	0.82	Neo-classical furniture and accent lighting
9	H	2.80	0.96	Aprofound and dark, mysterious space
10	D	2.55	0.69	Theme, common hue, insufficient depth in space

\*Average from 1 to 5.

Significant difference between DM and NDM students included Factor A, B, D, E, G, H, I and J. DM students preferred Factor A ( $F=26.157$ ,  $p=.000$ ,  $\omega^2=.037$ ), Factor D ( $F=8.091$ ,  $p=.005$ ,  $\omega^2=.011$ ), Factor G ( $F=58.573$ ,  $p=.000$ ,  $\omega^2=.080$ ), and Factor H ( $F=167.500$ ,  $p=.000$ ,  $\omega^2=.200$ ). NDM students had significance on Factor B ( $F=131.633$ ,  $p=.000$ ,  $\omega^2=.164$ ), Factor E ( $F=81.768$ ,  $p=.000$ ,  $\omega^2=.108$ ), Factor I ( $F=49.822$ ,  $p=.000$ ,  $\omega^2=.068$ ), and Factor J ( $F=14.584$ ,  $p=.000$ ,  $\omega^2=.020$ ). Factor C and F showed no major significance (Table 3).

**Table 3: Analysis of Variance on Aesthetic Factor Regarding Academic Major**

Aesthetic Factor	Mean±SE <sup>a</sup>		F value	Strength of Association $\omega^2$
	DM	NDM		
A	3.45±.565 <sup>a</sup>	3.20±.706	26.157***	.037
B	3.08±.568	3.61±.626	131.633***	.164
C	3.59±.614	3.67±.712	2.032	.002
D	2.63±.671	2.48±.706	8.091**	.011
E	3.05±.652	3.56±.788	81.768***	.108
F	3.26±.737	3.28±.865	.109	.001
G	3.37±.620	2.95±.771	58.573***	.080
H	3.24±.855	2.38±.855	167.505***	.200
I	2.73±.550	3.05±.611	49.822***	.068
J	2.69±.781	2.94±.849	14.584***	.020
H <sub>1</sub>	3.36±.459	3.05±.585	59.977***	.082
H <sub>2</sub>	3.00±.419	3.25±.431	58.394***	.080

Remarks: a Average from 1 to 5 ; \*\*\*p<0.001 ; \*\*p<0.01 ; \*p<0.05

Genders had apparent significance on Factor A, B, E, H, and I. Males preferred Factor B (F=34.286, p=.000,  $\omega^2=.048$ ), Factor E (F=32.584, p=.000,  $\omega^2=.045$ ), and Factor I (F=18.700, p=.000,  $\omega^2=.026$ ). Females favored Factor A (F=15.759, p=.000,  $\omega^2=.022$ ) and Factor H (F=31.438, p=.000,  $\omega^2=.042$ ) (Table 4).

**Table 4: Analysis of Variance on Aesthetic Factor Regarding Gender**

Aesthetic Factor	Mean ± SE <sup>a</sup>		F value	Strength of Association $\omega^2$
	Male	Female		
A	3.22±.656 <sup>a</sup>	3.42±.636	15.759***	.022
B	3.50±.646	3.21±.631	34.286***	.048
C	3.61±.692	3.65±.642	.415	.000
D	2.58±.705	2.53±.682	.683	.000
E	3.48±.785	3.15±.714	32.584***	.045
F	3.30±.823	3.23±.787	1.119	.000
G	3.12±.780	3.18±.680	1.281	.000
H	2.60±.940	3.00±.932	30.438***	.042
I	3.00±.620	2.80±.570	18.700***	.026
J	2.88±.871	2.76±.773	3.730	.004
H <sub>1</sub>	3.13±.566	3.27±.525	11.277**	.015
H <sub>2</sub>	3.20±.435	3.05±.437	21.357***	.030

Remarks: a Average from 1 to 5 ; \*\*\*p<0.001 ; \*\*p<0.01 ; \*p<0.05

Average on Factor A, B, D, E, G, and H reached significance when it comes to grade. After Scheffemultiple comparison analysis, significance of each factor by different grades as followed:(1) Factor A, sophomore showed higher average than junior and senior.(2)Factor B, freshman demonstrated higher average than all other grades. (3) Factor D, sophomore was higher than junior. (4) Factor E, senior was higher than sophomore. (5) Factor G, sophomore showed higher average than junior and senior and freshman were higher than junior. (6) Factor H, sophomore expressed higher average than all other grades. Table 5 demonstrated significance on aesthetic factors by different grades. The strength of association in the descending order were Factor H, B, A, G, D, and E.

Table 5: Analysis of Variance on Aesthetic Factor Regarding Gender

Aesthetic Factor	Mean±SE <sup>a</sup>				F value	Strength of association $\omega^2$	Scheffe
	Freshman (1)	Sophomore (2)	Junior (3)	Senior (4)			
A	3.37±.683 <sup>a</sup>	3.53±.595	3.20±.684	3.25±.599	8.681***	.034	2>3,4
B	3.61±.678	3.18±.632	3.36±.638	3.32±.622	10.785***	.042	1>2,3,4
C	3.68±.654	3.66±.606	3.57±.691	3.63±.695	.902	.000	
D	2.59±.726	2.70±.622	2.48±.672	2.50±.733	3.560*	.011	2>3
E	3.32±.768	3.14±.642	3.36±.777	3.38±.836	3.275*	.010	4>2
F	3.35±.818	3.23±.733	3.19±.831	3.32±.818	1.554	.002	
G	3.24±.785	3.34±.662	3.01±.769	3.10±.664	6.992***	.026	2>3,4; 1>3
H	2.66±.953	3.23±.871	2.69±.972	2.67±.912	14.118***	.056	2>1,3,4
I	2.95±.527	2.79±.523	2.95±.624	2.88±.678	2.574	.007	
J	2.88±.862	2.76±.737	2.82±.822	2.82±.874	.495	.000	
H <sub>1</sub>	3.24±.557	3.38±.486	3.08±.591	3.15±.506	9.700***	.038	2>3,4
H <sub>2</sub>	3.22±.428	3.07±.418	3.12±.434	3.11±.476	2.828*	.008	1>2

Remarks: a Average from 1 to 5 ; \*\*\*p<0.001 ; \*\*p<0.01 ; \*p<0.05

### The Second Survey

With a recall of valid 511 questionnaires, followings were basic background of the participants.

- Academic major: 221 DM students, and 290 NDM students (i.e. civil engineering, industrial engineering, sports and leisure, and electrical engineering, etc.)
- Gender: 136 males and 375 females.
- Grade: 174 freshmen, 133 sophomores, 166 juniors, and 38 seniors.

Followings are the results of questionnaire analysis via SPSS 18.0.

The aesthetic level average of each factors in a descending order were: (Table 6)

Table 6: Ranking and Characteristics of Each Aesthetic Factor

Ranking	Factor	Average*	Standard Deviation	Major Characteristics
1	C	4.18	.903	Natural lighting and visual penetration
2	A	4.07	.670	Regular style and bright colors
3	F	3.97	1.02	Dramatic lighting effect and cool-toned texture
4	I	3.96	1.12	Pure background sets off a lively and diverse furnishings
5	B	3.77	.927	Concise stripe, steady hue and conventional texture
6	E	3.77	.979	Design-featured furniture and decoration
7	J	3.55	1.13	Neo-classical furniture and accent lighting
8	G	3.50	.948	Modest hue, style and lighting change
9	H	3.39	.984	A profound and dark, mysterious space
10	D	3.15	.846	Theme, common hue, insufficient depth in space

Remarks:\*Average from 1 to 5

Significant difference between DM and NDM students included Factor A, B, C, D, E, F, G, I and J. DM students preferred Factor A (F=11.420, p=.001,  $\omega^2$ =.020), Factor B (F=145.835, p=.000,  $\omega^2$ =.221), Factor C (F=7.778, p=.005,  $\omega^2$ =.013), Factor D (F=6.520, p=.011,  $\omega^2$ =.011), Factor E (F=70.097, p=.000,  $\omega^2$ =.011), Factor F (F=19.357, p=.000,  $\omega^2$ =.108), Factor I (F=98.583, p=.000,  $\omega^2$ =.068), and Factor H (F=57.011, p=.000,  $\omega^2$ =.020). NDM students had significance on Factor G (F=6.805, p=.009,  $\omega^2$ =.011). Factor H showed no major significance (Table



7).

**Table 7: Analysis of Variance on Aesthetic Factor Regarding Academic Major**

Aesthetic Factor	Mean±SE <sup>a</sup>		F value	Strength of Association $\omega^2$
	DM	NDM		
A	3.96±.620 <sup>a</sup>	4.16±.695	11.420**	.020
B	3.27±.877	4.15±.770	145.835***	.221
C	4.06±.866	4.28±.921	7.778**	.013
D	3.04±.865	3.23±.822	6.520*	.011
E	3.38±.933	4.06±.906	70.097***	.119
F	3.75±.947	4.14±1.042	19.357***	.035
G	3.63±.936	3.41±.947	6.850**	.011
H	3.39±.948	3.39±1.012	.000	.000
I	3.45±1.071	4.36±.994	98.583***	.161
J	3.14±1.066	3.86±1.077	57.011***	.099

Remarks: a Average from 1 to 5 ; \*\*\*p<0.001 ; \*\*p<0.01 ; \*p<0.05

Both male and female had significance on Factor B (F=10.612 , p=.001 ,  $\omega^2$ =.018) and Factor E (F=6.056 , p=.014 ,  $\omega^2$ =.010). Moreover, males were more preferable to these two factors than female (Table 8).

**Table 8: Analysis of Variance on Aesthetic Factor Regarding Gender**

Aesthetic Factor	Mean±SE <sup>a</sup>		F value	Strength of Association $\omega^2$
	Male	Female		
A	4.09±.660 <sup>a</sup>	4.07±.675	.116	.000
B	3.99±.849	3.69±.942	10.612**	.018
C	4.16±.833	4.19±.928	.123	.000
D	3.17±.833	3.14±.851	.089	.000
E	3.94±.941	3.70±.985	6.056*	.010
F	3.95±1.024	3.98±1.019	.064	.000
G	3.50±1.046	3.50±.911	.003	.000
H	3.47±.963	3.36±.991	1.239	.000
I	3.99±1.083	3.95±1.137	.101	.000
J	3.65±1.042	3.51±1.159	1.485	.001

Remarks: a Average from 1 to 5 ; \*\*\*p<0.001 ; \*\*p<0.01 ; \*p<0.05

Six factors showed significance when it comes to grade. Factor B (F=4.718 , p=.003 ,  $\omega^2$ =.021), Factor C (F=3.118 , p=.026 ,  $\omega^2$ =.012), Factor D (F=6.181 , p=.000 ,  $\omega^2$ =.030), Factor F (F=6.298 , p=.000 ,  $\omega^2$ =.030), Factor I (F=7.484 , p=.000 ,  $\omega^2$ =.037), and Factor J (F=11.760 , p=.000 ,  $\omega^2$ =.060). After Scheffemultiple comparison analysis, significance of each factor by different grades as followed: (1) Factor B and D: freshman was higher than junior. (2) Factor F: freshman was higher than sophomore. (3) Factor I and J: freshman showed higher average than sophomore and junior. The strength of association in the descending order regarding grades on aesthetic factors was Factor J, I, F, D, B, and C (Table 9).

**Table 9: Analysis of Variance on Aesthetic Factor Regarding Gender**

Aesthetic Factor	Mean±SE <sup>a</sup>				F value	Strength of Association $\omega^2$	Scheffe
	Freshman (1)	Sophomore (2)	Junior (3)	Senior (4)			
A	4.13±.646 <sup>a</sup>	3.96±.723	4.09±.618	4.12±.786	1.695	.004	
B	3.96±.864	3.75±.973	3.59±.939	3.81±.845	4.718**	.021	1>3
C	4.25±.926	4.25±.903	4.01±.898	4.38±.728	3.118*	.012	
D	3.34±.851	3.12±.817	2.96±.809	3.18±.906	6.181***	.030	1>3
E	3.88±.875	3.79±1.140	3.67±.948	3.57±.909	1.890	.005	
F	4.19±.940	3.69±1.100	3.95±.955	4.03±1.143	6.298***	.030	1>2
G	3.54±.926	3.39±.981	3.55±.947	3.48±.932	.830	.000	
H	3.48±.982	3.24±1.042	3.42±.920	3.30±1.024	1.639	.004	
I	4.27±1.028	3.89±1.100	3.71±1.203	3.91±.950	7.484***	.037	1>2,3
J	3.90±1.105	3.17±1.234	3.52±.984	3.37±.991	11.760***	.060	1>2,3

Remarks: a Average from 1 to 5 ; \*\*\*p<0.001 ; \*\*p<0.01 ; \*p<0.05

## CONCLUSIONS

There are ten aesthetic factors from the study results. Through different times and participants, the survey showed consistency and stability in aesthetic factor structure. Judging from the top four aesthetic factors, natural lighting and visual penetration, regular style and bright colors, dramatic lighting effect and cool-toned texture, and pure background sets off lively and diverse furnishings were more appealing to college students regarding interior environment. In other words, interior environment would be more appealing as it uses natural and stylish lighting, vivid colors, and various decorations. Considering the last three factors, it is obvious that a design with dark, regular shade, or too shadowy and superficial would not be popular with the general public.

When it comes to DM and NDM students, nine out of ten factors showed significance. It proved that the current empirical study result to be true that “professional space designers have significantly different preferences than the public general regarding man-made environment”. These professionally trained designers are miraculously obsessed with the distance reflected by modest hue and mysterious darkness. While the general public mostly prefer Minimalism, such as calm shade, simple stripe, pure background, and decorative furniture, designer’s obsession is just too hard to comprehend. It is suggested that designers should pay more attention to the different preferences.

Comparing to academic major and grade, aesthetic preference was less effected by gender. Only Factor B and C showed differences. The study results indicated that male preferred the Japanese Minimalism style with concise stripe, steady hue and traditional texture and design-featured furniture and decoration.

As for grade, sophomore and junior seemed uninterested in aesthetics than freshman, however; there’s no major difference between freshman and senior. It showed that sophomore is the turning point of aesthetic psychology. What is the main reason for the negative tendency? It could be impacts from environmental education or the psychological growth. This is an issue that worthy developing for understanding more regarding aesthetic education for college students.

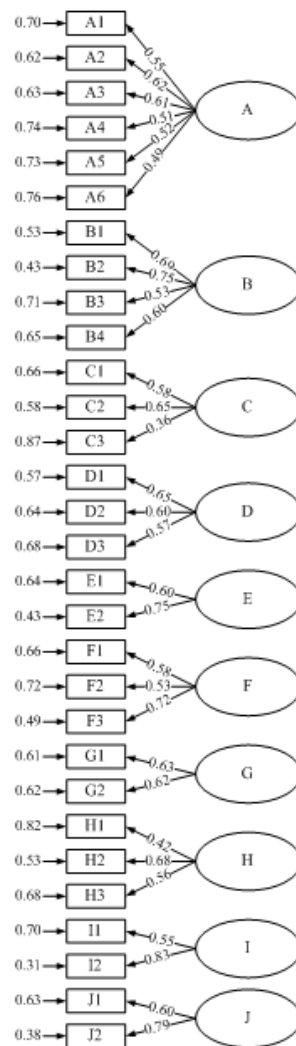


Figure 1: Standardized Parameter Estimation of Empirical Factor Analysis on Aesthetics

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