

Interpretation of Space: From Images to Vocabulary

Li-Yu Chen^{1(✉)}, Ya-Juan Gao², Wun-Cong Yen¹, and Ching-Hui Huang¹

¹ Department of Interior Design, Chung Yuan Christian University,
Chung-Li/Taoyuan City, Taiwan

chenly99@gmail.com, wcyan1990@gmail.com, b3017987@ms22.hinet.net

² Graduate School of Creative Industry Design, National Taiwan University of Arts,
Ban Ciao/New Taipei City, Taiwan
78343821@qq.com

Abstract. Interior design can be executed in various stages, during which designers (the sender) deliver their ideas to clients (the receiver) via communication channels (the medium) in the form of language, words, images, and drawings. The question is whether the sender and receiver have a mutual understanding and interpretation of the message or not determines if the design is able to satisfy the client's needs. In order to understand the different backgrounds of receivers (professionals and non-professionals), it is important to note if they have different spatial perceptions when interpreting the same spatial image and if they use different spatial vocabulary to describe how they feel. Images and vocabulary are used as research materials. With spatial images and vocabulary as research instruments, professionals (designers with more than five years of work experience) and non-professionals (college freshmen) are asked to complete questionnaires to analyze the different spatial vocabulary used by professionals and non-professionals for the same spatial image as well as the two groups of participants' different interpretations towards spatial vocabulary based on their written descriptions. Research findings show that: (1) spatial vocabularies that describe an interior space need to be able to clearly identify the characters, ambience, and style of the space; (2) if a space has obvious differences in style, color, and material, vocabularies become more consistent; (3) the abundance and complexity of furniture play an important role; for example, less furniture or simple furnishings tend to be interpreted as simple or basic.

Keywords: Communication · Interpretation · Vocabulary · Spatial perception

1 Introduction

In an existing building, an interior space can be divided into segments with elements such as ceilings, walls, and floors and its spatial ambience is created with style, colors, and materials to satisfy the user's psychological perception and needs. Interior design is the creative process of interior space composition. The job can be divided into design (drawing) and decoration (construction), each requiring different participants to complete the job. During the design process, the owner of the space expresses his or her needs and preferences in spoken words, written words, or pictures to the designer. After

receiving the message, the designer will convey the ideas verbally, in words, or on drawing or animations. A design project is formed through the concept, development, and implementation stages. The cognitive ability of drawings and ability to describe using text and speech are important factors that affect the understanding of space. Therefore, during communication, the designer and owner could interpret the messages differently. In this case, communication and mutual understanding is a vital part of conveying ideas effectively and achieving your dream design.

Chiu and Yan (1996) showed that a designer usually communicates with the consumer using words, text, or pictures. Messages delivered between the sender and the receiver may be obstructed or distorted due to misinterpretation during the process of coding and recalling [1]. Vocabulary is the rational logical thinking and symbols accumulated through visual experience. Specific of text code must be made through convention in order to achieve communication [2].

Kaplan (1981) argued that spatial cognition is a process during which humans store, perceive, and reconstruct environmental stimulus. Spatial cognition can be considered as the process where people modify and organize information after being stimulated by the environment or space and then convey their understanding through words or images [3].

Previous studies have shown that media such as vocabulary, images, and pictures are mostly used to explore the user's preference and perception towards an interior space through 2D or 3D simulation and perform a differential analysis. Wang (2004) employed PC-MDS to analyze the spatial cognition framework of interior designers and consumers from "spacious and splendid" to "simple and plain" and from "daring and innovative" to "traditional and antique" [4]. Chuang (2010) aimed to understand the relationship between the physical features of built environment and the human aesthetic responses, they undertook this study to explore different instruments and methods for empirical aesthetic evaluation and used pictures of interior design house furnished as the investigation instrument, and conducted two investigations. A total of 1176 effective samples were collected in this research [5]. Hsu (2011) used the theory of color harmony to explore people's perception towards different color combinations and performed an analysis on the vocabulary and color harmony of a living space [6]. Cheng (2014) created a spatial sample with computer simulation to evaluate psychological response using the semantic differential technique and explored the emotional responses, scenario perception, spatial perception, and preference of participants towards different interior styles and color harmonies [7]. Hong (2009) employed explorative factor analysis to investigate consumers' cognitive levels towards interior designers and the elements affecting their choice of interior designer and design style. Hong also explored the differences in cognitive levels, factors influencing their choice of interior designer and design style between consumers with different backgrounds [8].

Spatial perception is a person's cognitive level, ability to control, user preference, and affective response of the surrounding environment and the reaction towards various components of space [9].

Spatial descriptive ability refers to the perceptions produced from personal preferences and subjective opinions of the observed space. The shape, material, and ambiance of the interior space are then conveyed through text, words, pictures, and images. Liang

(2006) indicate that in the thinking process, hand drawings, design drawings, images and pictures, and text are used to communicate design ideas. In terms of drawings, the designer uses drawings based on personal preference and experience to communicate. Thus, the designer's values have an effect on the use and judgement of drawings [10].

On the other hand, photos are mainly used to record and capture images through photography, transforming complex spatial sequence into simple still images and recreating space through perspective drawings [11].

Vocabulary refers to a collection of words and is used as a tool for communication and knowledge acquisition. It changes with time, age, and background. Different vocabulary can be used to describe the same object. Chu (2006) views vocabulary as a type of symbol or sign that carries correct information. Therefore, the functions and style of design projects are signs reflecting the designer's intuitive interpretation and cognition [12]. Chen and Yan (2016) indicate Spatial vocabulary refers to nouns and adjectives that are used to describe spatial feelings or perceptions and to acquire knowledge. Chi (2014) applied Kansei Engineering to explore the relationship between affective vocabulary and living room environment components and established a parameter-based bi-prediction model [13].

During various stages, designers (the sender) deliver their ideas to clients (the receiver) via communication channels (the medium) in the form of language, words, images, and drawings. The question is whether the sender and receiver have a mutual understanding and interpretation of the message or not determines if the design is able to satisfy the client's needs. This study aims to understand the different backgrounds of receivers (professionals and non-professionals) by exploring the different spatial perceptions they have when interpreting the same spatial image and if they use different spatial vocabulary to describe how they feel.

2 Research Framework

Sun et al. (2009) performed an experiment on participants from different grades in university where they were asked to read a text of words and convert what they interpreted into a drawing. The research found that, whether or not they took storyboarding training, in terms of the cognition of images, the results were different. Moreover, participants showed limitless imagination in the surreal scenario image [3].

Therefore, this study tested the hypothesis that professionals and non-professionals have different spatial perceptions of the same interior space and use different spatial vocabulary when describing their feelings based on their work experience, communication tools, and preference of expression.

This study is divided into three stages. The first stage involves the screening of spatial images and vocabulary, during which text and pictures are extracted from design projects. In the second stage, participants pick vocabulary for every image and specify the reason for choosing them. The purpose is to analyze the difference between cognitive levels and communication skills of professionals and non-professionals. The third stage is where the second questionnaire survey was conducted. Based on the previous survey results, we came to the conclusion that the selection of spatial vocabulary and images

should be redefined to prevent similar pictures or words with similar meanings from affecting participants. For the second questionnaire survey, participants choose spatial images and vocabulary again based on spatial features and ambience with the aim to explore the effect of seniority, communication tools, and communication methods on communication ability Table 1.

Table 1. Framework for interpreting images to vocabularies

Spatial images and spatial vocabulary screening		Spatial vocabulary survey (first)	Spatial vocabulary survey (second)
Purpose	Collect spatial vocabulary and images to describe projects	Investigate the difference of spatial vocabulary used by participants with different backgrounds	Explore the effect of seniority, communication tools, and communication methods on communication skills of participants with different backgrounds
Subject	Text and pictures from projects featured in 12 issues of Taiwan interior design magazine from 2014 to 2015	Professionals (designers with over five years of experience) and non-professionals (college freshmen)	Professionals (designers with over five years of experience) and non-professionals (college freshmen)
Method	Extract 134 nouns and adjectives from Taiwan interior design and select 46 spatial vocabularies	Provide 46 vocabulary choices for each spatial image for on-site and online questionnaire survey	Screen spatial vocabulary and images based on spatial characters and ambience and modify the questionnaire for a second survey

3 Spatial Vocabulary and Spatial Images

Taiwan Interior Design is the only professional and official magazine published by the National Association of Interior Design in Taiwan. Therefore, this study chooses to use pictures and text taken from this publication.

3.1 Screening of Spatial Vocabulary

Spatial vocabulary used in this study is taken from articles about design projects featured in 12 issues of Taiwan Interior Design bimonthly from 2014 to 2015. According to similarities and frequency of appearance, 134 nouns and adjectives are selected and categorized into spatial element, spatial scale, style and characteristics, color, material, spatial ambience, spatial style. The vocabularies are then screened based on univocal words and synonyms. Univocal vocabulary include pure (27), harmony (5), monotonous (3), complete (2), extend (17), flow (9),

repressed (9), smooth and shiny (2), round (2), long and slim (1), bright (28), saturated (6), colorful (3), elegant (4), soft (15), plain (13), light (8), rigid (7), decorative (4), texture (3), solid (2), transparent (2), aesthetic (78), simple (54), romantic (12), lavish (38), and mix-and-match (7). Synonyms (19 groups) include varied (8), open-spaced (39), penetrating (33), warm (47), comfortable (113), relaxing (34), unique (87), abundant (52), fun (46), sweet (18), private (11), graceful (45), joyful (4), modern (74), fashionable (24), basic (51), luxurious (44), classical (7), and retro (14). A total of 46 spatial vocabularies are selected for this study Table 2.

Table 2. Spatial vocabulary (first screening)

Attribute	Item	Univocal	Synonym
Interior space definition	Spatial elements	Pure, harmony, monotonous, complete	Varied
	Spatial scale	Extend, flow, repressed	Open-spaced, penetrating
Interior space components	Style and characteristics	Smooth and shiny, round, long and slim	
	Color	Bright, saturated, colorful, elegant	
	Material	Soft, plain, light, rigid, decorative, texture, solid, transparent	Warm
Interior space properties	Spatial ambience	Aesthetic, simple, romantic	Comfortable, relaxing, unique, abundant, fun, sweet, private, graceful, joyful
	Spatial style	Lavish, mix-and-match	Modern, fashionable, basic, luxurious, retro, classical

3.2 Screening of Spatial Images

A total of six interior design projects in the housing category honored by the 4th annual Golden Creativity Award organized by the National Association of Interior Design featured in Taiwan Interior Design are used as subjects. Projects include one gold, silver, and bronze winner each in category A (below 50 ping) and category B (over 50 ping). As the magazine only features distinguishing characteristics of design projects, it lacks a complete and detailed description of space. Therefore, the following criteria is followed during the screening process: (1) the main visual photo of projects reported in the magazine; (2) living rooms and dining rooms are primary choices as they present a more complete spatial composition (e.g., ceiling, floor, wall, furniture) so bathrooms, toilets, cloakrooms, or walk-in closets are not considered (Table 3).

Table 3. Spatial images (first screening)

4 Spatial Vocabulary for Interpreting Images

4.1 First Questionnaire Survey

The 46 spatial vocabulary and six spatial images are used to perform a six-question test. Each question is presented on an A4 paper on which a spatial image is attached with 46 spatial vocabularies to choose from and a blank space beneath. The images are arranged in the order of award levels (gold, silver, and bronze). Participants are asked to fill out questionnaires on site or online. The former involves a written questionnaire and projected images that are displayed from numbers one to six with each image playing for three minutes. For the latter, a website linking to the online questionnaire is given to participants to complete.

To allow the images to be more realistic, the spatial images are first scanned and converted into PDF files with a resolution of 300×300 dpi. However, due to different scanners, the colors in spatial images and magazine pictures may vary slightly.

Participants include professionals and non-professionals. Professionals are designers with more than five years of experience in interior design. Considering that the participants come from different places and cannot all be interviewed in person, online questionnaires are created for their convenience. Thirty valid questionnaires returned. Non-professionals refer to college freshmen majoring in interior design at Chung Yuan Christian University (CYCU). At a requested time and place, they are given 20 min to choose suitable words to describe their feelings towards a spatial image and write down the reason why. Out of the 57 questionnaires distributed, 30 valid ones returned.

4.2 Survey Results and Discussion

The frequency of the spatial vocabularies chosen for the spatial images is tested. From the highest to lowest number of times, the result is decorative (25), texture (20), extend (17), plain (16), and elegant (16).

According to Table 4, the word that appears the most times in Fig. 1 and Fig. 1-6 is “decorative”. The two images both contain a variety of furniture to create a “decorative” spatial ambience. In Fig. 1-2 and Fig. 1-4, “texture” is used the most times to describe participants’ feelings. The two images both feature marble and wooden furnishings.

Table 4. Analysis of spatial vocabulary (first questionnaire survey)

Fig 1-1	Fig 1-2	Fig 1-3	Fig 1-4	Fig 1-5	Fig 1-6
					
Professionals	Non-professionals	Professionals	Non-professionals	Professionals	Non-professionals
Decorative (10)	Decorative (10)	Texture (20)	Texture (14)	Decorative (18)	Decorative (25)
Colorful (8)	Texture (9)	Simple (12)	Texture (12)	Texture (17)	Decorative (18)
Varied (7)	Decorative (10)	Spacious (7)	Harmony (9)	Simple (9)	Varied (5)
Complete (8)	Rigid (10)	Simple (13)	Spacious (12)	Spacious (12)	Texture (5)
Colorful (8)	Decorative (7)	Spacious (8)	Penetrating (10)	Penetrating (10)	Saturated (7)
Spacious (5)	Complete (4)	Extend (5)	Harmony (9)	Harmony (9)	Varied (6)
Harmony (5)	Simple (4)	Long and slim (5)	Spacious (5)	Spacious (5)	Solid (5)
	Varied (7)	Long and slim (6)	Elegant (5)	Elegant (5)	Saturated (5)
		Monotonous (6)	Elegant (8)	Elegant (7)	Solid (6)
		Long and slim (5)			

Based on the five spatial vocabularies with the highest frequency rate and the reasons participants gave, four vocabularies including decorative, texture, extend, plain, and elegant were all chosen by non-professionals, indicating that college freshmen tend to use the same words and have the same feelings towards an image due to their similar learning environment and courses. Professionals, on the other hand, come from different backgrounds and therefore tend to have different feelings and use of words.

The main findings of this survey are as follows:

- (1) Confusing vocabularies: Some of the spatial vocabularies selected from the first screening process are unable to clearly describe an interior space. For example, extend, round, long and slim, saturated, and soft may confuse participants.
- (2) Similar images: Some of the spatial images are too similar, making it difficult for participants to choose suitable words for them.
- (3) Differences in cognitive levels: According to the frequency test, non-professionals typically show the same cognitive levels for an image due to the fact that they learn from same educational environments, while professionals have different backgrounds and therefore tend to show more differences in their cognitive levels. Based on the reasons participants provided, despite both choosing the word “decorative” for Fig. 1, professionals and non-professionals have different reasons. Professionals think that detailed with molding and complex chandelier are decorative, while non-professionals think that variety of furniture enhance a living space.
- (4) Differences in communication skills: Nine questionnaires indicate that non-professionals are unable to clearly describe their spatial perceptions with words, which may be because of their lack of professional training in interior design since they are only taking beginner courses in freshman year. Professionals have more experience in the interior design sector and therefore are equipped with better communication skills.

4.3 Second Questionnaire Survey

The results of the first survey show a significant difference in using words to describe spatial perceptions between professionals and non-professionals. In terms of choosing spatial vocabulary, non-professionals use more or less of the same words while professionals show more of a variety in choosing vocabularies. However, images that are too similar or words that have similar meanings easily confuse participants and affect their choices. Therefore, it is important to choose more specific spatial vocabulary and spatial images based on the characteristics, ambience, and style of a spatial composition. Design communication questions are also added to investigate whether communication tools and methods professionals and non-professionals adopt affect their choices.

Regarding spatial vocabulary screening, words that are unable to clearly describe a space are eliminated, namely pure, harmony, monotonous, complete, extend, flow, round, long and slim, bright, saturated, colorful, elegant, soft, plain, rigid, decorative, transparent, penetrating, warm, relaxing, unique, fun, and joyful. The remaining 23 vocabularies are then divided into three categories: (1) spatial characters: open-spaced, private, solid, smooth and shiny, varied, repressed, light, texture; (2) spatial ambience:

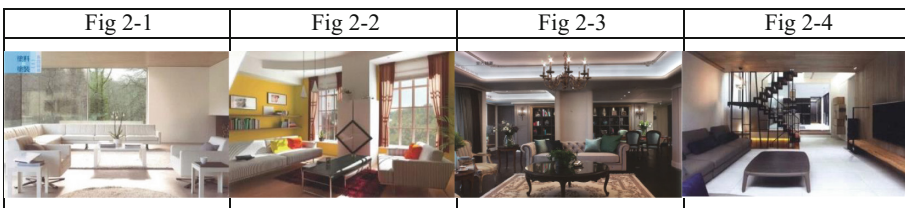
abundant, simple, comfortable, sweet, romantic, aesthetic, graceful; (3) spatial style: fashionable, luxurious, lavish, mix and match, retro, basic, classical, and modern (Table 5).

Table 5. Spatial vocabulary (second screening)

Spatial character	Spatial ambience	Spatial style
Open-spaced	Abundant	Fashionable
Private	Simple	Luxurious
Solid	Comfortable	Lavish
Smooth and shiny	Sweet	Mix and match
Varied	Romantic	Basic
Repressed	Aesthetic	Classical
Light	Graceful	Retro
Texture		Modern

To prevent participants from having difficulty choosing suitable spatial vocabulary because some spatial images are too similar, this time 12 images are chosen from the magazine based on spatial definition elements (ceiling, floor, area, furniture) for participants to give subjective opinions on each image according to the main items of spatial perception (style, color, material). Then, four images with the biggest difference in each item are chosen; that is, images with different spatial perceptions as shown Table 6.

Table 6. Spatial images (second screening)



In the second questionnaire, questions are redesigned for four spatial images and 23 spatial vocabularies. New questions about design communication tools and design communication methods are added to explore the differences between professionals (designers) and non-professionals (college freshmen).

4.4 Survey Results and Discussion

According to Table 7, the results show: (1) the tools designers and owners use to communicate are design drawings, verbal communication, written words, and actual models; (2) the tools designers and construction workers use to communicate are design drawings, verbal communication, actual models, and written words; (3) the tools students and teachers use to communicate are verbal communication, design drawing, and actual models.

Table 7. Design communication methods

Subjects		Written words	Verbal communication	Design drawings	Actual models
Professionals	Designers to client	7.1%	28.6%	71.6%	3.6%
	Designers to workers	3.6%	17.9%	82.1%	8.7%
Non-professionals	Students to teachers	0%	43.8%	40.6%	15.6%

As shown in Table 8, in terms of means of communication, professionals (designers) believe that proper transmission of information, knowledge and skills, reaching a consensus, and excellent communication skills are most important. On the other hand, non-professionals (college freshmen) consider proper transmission of information, excellent communication skills, reaching a consensus, and knowledge and skills as priorities. This shows that professionals think knowledge and skills and reaching a consensus are far more important than excellent communication skills.

Table 8. Effective communication methods

Subjects	Proper transmission of information	Excellent communication skills	Reaching a consensus	Knowledge and skills
Professionals	46.4%	10.7%	17.9%	25%
Non-professionals	62.5%	18.8%	9.4%	9.4%

In Fig. 2-1, which mainly features the color white, non-professionals use open-spaced, simple, and basic the most while professionals use open-spaced, comfortable, and basic more.





In Fig. 2-2, which has a richer variety of colors, non-professionals and professionals use varied, abundant, and mix and match.

In Fig. 2-3, which contains classical furnishings, non-professionals use texture, graceful, and basic while professionals use texture, graceful, and classical.

In Fig. 2-4, which is more simple and open-spaced, non-professionals use open-spaced, simple, and basic while professionals use texture, simple, and modern (Table 9).

Compared to the results of the first questionnaire survey, the second questionnaire produced more distinctive results; participants did not have difficulty answering the questions. Therefore, professionals and non-professionals all use the same words for Figs. 2-1, 2-2, and 2-3 (open-spaced, varied, and texture, respectively) and their second choice of words is also the same for Figs. 2-2, 2-3, and 2-4 (abundant, graceful, and simple, respectively).

Table 9. Selection of spatial vocabulary (second questionnaire)

	Fig 2-1	Fig 2-2	Fig 2-3	Fig 2-4
Image				
Professionals	Open-spaced, comfortable, basic	Varied, abundant, mix and match	Texture, graceful, classical	Texture, simple, modern
Non-professionals	Open-spaced, simple, basic	Varied, abundant, mix and match	Texture, graceful, basic	Open-spaced, simple, basic

5 Conclusion

Spatial cognition refers to the acquisition, organization, and classification of information obtained from spatial environments. Communication is required to reach a consensus between information and cognition. Interior design is the communication process that presents a design idea by means of words, text, drawings, and animation. In other words, communication media is the key to making the information sent by the sender and information received by the receiver consistent. This study provides different spatial images for professionals and non-professionals to interpret and spatial vocabulary for them to choose. After two questionnaire surveys, the main findings of this study are as follows: (1) spatial vocabularies that describe an interior space need to be able to clearly identify the characters, ambience, and style of the space; (2) if a space has obvious difference in style, color, and material, vocabularies become more consistent; (3) the abundance and complexity of furniture play an important role; for example, less furniture or simple furnishings tend to be interpreted as simple or basic.

References

1. Chiu, M.L., Yen, S.J.: Design representations and visual communication phenomena in the architectural design process. *J. Des.* **3**(2), 87–110 (1998)
2. Sun, C.W., Chen, C.H., Chiang, S.B.: The differences in visual interpretation of scene framing incurred during converting situational descriptions into visual images. *J. Des.* **14**(4), 1–22 (2009)
3. Li, H.C.: A study on the influence of illuminance and color temperature of artificial lighting on visual perception and survey of lighting models-using living room as an example. Unpublished master thesis, Department of interior design, Chung Yuan Christian University, Chung-li (2002)
4. Wang, T.H.: A study of residential interiors’ spatial images. Unpublished master thesis, Department of interior design, Chung Yuan Christian University, Chung-li (2004)
5. Chuang, H.T., Liu, S.Y., Chen, J.H., Wu, M.H.: The aesthetic evaluation of furnished interior space. *J. Architect.* **74**, 155–174 (2010)
6. Hsu, H.Y.: A study on the visual image of home space applied to color harmony theory. Unpublished master thesis, Department of Visual Communication Design, National Yunlin University of Science and Technology, Yunlin (2011)

7. Cheng, Y.R.: An investigation on the preferences of subjects for different interior style and tone, Unpublished master thesis, Department of Architecture and urban design, Chao Yang University of Technology, Taichung (2014)
8. Hong, J.K.: The residential interior design style and space consumer demand. Unpublished master thesis, Department of Mathematic, Chung Hua University, Shin-Chu (2009)
9. Jan, H.T.: *Urban People: The Sense, Symbol and Explanation of Urban Space*. Commonwealth Publishing Company, Taipei (1996)
10. Liang, C.Y.: The thinking and presentation in drawings -a study from the book, why architects draw. Unpublished master thesis, Department of Architecture, National Taiwan University of Science Technology, Taipei (2006)
11. Chen, L.Y., Yen, W.C.: Discussion on the cognition and expression of interior design from the perspective of communication. In: *The 12th Conference of CIIAD*, Yunlin (2016)
12. Chu, S.T., Lee, C.F.: A study on the form phrase of switch movement with semantics perspective for 3C products. *J. Des. Res.* **6**, 210–218 (2006)
13. Chi, T.Y.: The element and structure of house living room research by Kansei engineering. Unpublished master thesis, Department of interior design, Chung Yuan Christian University, Chung-li (2004)