A STUDY OF VISUAL IMAGERY ON COMMERCIAL HARDWOOD (BROAD-LEAVED TREE) MATERIALS OF TAIWAN

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ABSTRACT

In this paper, we study the experiences of visual imagery in Taiwan's commercial hardwood (broad-leaved tree) materials. Total 46 study samples, which comprised each piece of tangential, radial section made from 23 kinds of commercial hardwood materials, were provided by the Forestry Research Institute. A questionnaire survey was conducted with the Semantic Differential Scale, and a total of 72 valid questionnaires were collected, thereby, the findings highlighted: Among Taiwan's commercial hardwood materials, wherein, the advanced, elegant, and exquisite imagery were related to the tangential section of Swietenia mahogoni; and the warm, soft, and natural imagery were related to the radial section of Swietenia mahogoni; besides, the ordinary imagery was then related to the Paulownia taiwaniana's tangential section; and the meretricious, and raw imagery were related to the tangential section of Cassia siamea; and moreover, the cold, and blunt imagery were related to both the tangential and radial sections of Actinodaphne nantoensis; thereat, the artificial imagery was related to the Cyclobalanopsis longinux thereof.

Keywords: *Wood Materials, Visual imagery, Semantic Differential Scale*

1. INTRODUCTION

Currently the wood materials have been extensively applied in the field of product design or space design, and though the designers are able to interpret to their customers in terms of styles, colors and textures etc. while discussing the design specifications with them, however, customers may still have different feelings, and such feelings will tend to affect the consumers' preferences for judging the products. With regard to the aspect of users, when a person is looking at a product demonstrated by the varieties of wood materials in different colors and textures, such as: while purchasing building materials for the interior space…etc., how to make the right choice to select the appropriate materials within a short time to meet her (or his) psychological needs has become a difficult problem that annoys the said person all the time. If the designers can definitely possess this information, it will facilitate the

comprehension of design communication for both parties, and hence, to design a preferable product that can satisfy the consumer's psychological needs and feeling accordingly.

Besides, most Taiwanese people have only limited awareness of various timber materials supplied from different areas, especially there is a lack of adequate understanding of the Taiwan's commercial timbers, and nowadays, the current literatures rarely conducted a systematic survey of visual imagery for Taiwan's commercial timbers, and under this circumstance, the purpose of this study is to assess the visual imagery for the various commercial hardwood (broad-leaved tree) materials from Taiwan. Additionally, this study will analyze the common methods used to cut timber materials, the difference of imagery between the tangential and radial section in order to be served as a valuable reference for the design-related applications and future researches. It is expected that our research outcomes will contribute to the design of unique products, and thus, facilitating the implementation of Taiwan culture and creative industries.

2. LITERATURE REVIEW

Timbers have a unique impression of the nature beauty, where mankind has already customarily applied such characteristic to the wooden products and living environment. Therefore, since the late 1970s to the modern times, the issue related to wooden materials has always attracted much attention from many domestic and international research institutes or departments of wooden material science and engineering. And the term of imagery generally refers to the domain of the human mind or the feeling, wherein, the Semantic Differential Scale (SDS) was deemed to one of category in the relevant research field of imagery.

Presently, the famous domestic and foreign scholars dedicating to researches on the imagery of wooden materials comprise: Chen Tai-Sung (1997) proposed that the arrangement of wooden material's texture images in the horizontal and vertical orientation would will affect the people's mental imagery in a space; Lei Shih-Yu (2002) pointed out that different lifestyle groups would have a similar preference for the timber textures; and Toru Takahashi, Masaharu Suzuki, and Tetsuya Nakao (1995) emphasized, in accordance with the five-sense analysis of timber materials, the affinity imagery of wood grains as well as the warm imagery of colors, and also the influence of wood fiber on the painting's visual reflection, moreover, their additional research results including whether the amount of wood vessels would affect the visual brightness of painting or not etc.; in addition, Minoru Masuda (1989) suggested that the visual physical measurement of wood could affect the human's visual perception and visual imagery; and Yohei Kobayashi et al. (2006) proposed that the specialists had different viewpoints on the visual imagery of the wood textures from the average persons, where specialists undertook the visual analysis through the method of physical measurement, so their viewpoints on the wood textures' visual imagery were more consistency; and Yamada Misuzu et al. (2006) suggested that the grain direction of wood textures could influence the visual illusions about the dimension of space; while other researchers such as Shiraish Terumi et al. (2006) also emphasized that the similar processed imitation materials would not have a large difference in the feeling of visual and tactile imagery; and Ke Chao-Ming (1997) surveyed the imagery for 7 different kinds of materials while feeling them with either the visual or tactile sense, and instead, feeling them with both the visual and tactile senses at the same time, and whereat, the results showed that the

aforesaid two feelings were very similar to the feeling while using the visual sense only, but there was a larger difference between the aforesaid two feelings and the feeling by using the tactile sense only.

In light of above considerations, there is a lack of analysis related to the assessmenets on the visual imagery for the Taiwan's commercial timber materials in the field of domestic and foreign researches. So it is expecting that the findings of this study will be provided as a valuable reference for the continuous researches and the design-related applications as well.

3. RESEARCH METHODOLOGY, PROCEDURES AND ANALYSES

3.1. Study samples

The measured samples adopted in this study were 23 kinds of Taiwan's commercial hardwood (broad-leaved tree) materials based on timber classification in relevant literatures, whereby, total 46 samples comprising one piece of the tangential section and radial section from each tree species were supplied by Forestry Research Institute (Table 1). The tangential section was parallel to the trunk and was cut longitudinally without passing through the pith of a tree, its ring was either u- or v-shaped pattern (Figure 1); and the radial section was parallel to the trunk and was cut longitudinally through the pith of a tree, which had a straight tissue pattern (Figure 1).

Table 1: Tree species of commercial hardwood (broad-leaved tree) materials of Taiwan

N0	Species name	N0.	Species name
1	Michelia formosana	13	Cyclobalanopsis longinux
2	Trochodendron aralioides	14	Castanopsis carlesii Hay
3	Cinnamomum camphora	15	Lithocarpus amygdalifolius
4	Cinnamomun micranthum	16	Pasania brevicaudata
5	Machilus kusanoi	17	Pasania ternaticupula
6	Actinodaphne nantoensis	18	Zelkova formosana
7	Sasafras randaiense	19	Trema orientalis
8	Cassia siama	20	Schima superba
9	Acacia confusa	21	Fraxinus formosana
10	Schefflera actophylla	22	Paulownia taiwaniana
11	Alnus formosana	23	Swietenia mahogoni
12	Cyclobalanopsis gilva		

3.2. Preparation of questionnaires and tests

The adjective term of visual imagery, 116 in total, adopted in this study were the adjectives used to describe the timber materials in relevant literatures, which were screened by six specialists including three scholars specializing in the related field of furniture and interior design, and three interior designers with over 10 years working experience; and total 26 adjectives selected for more than 4 times, i.e. the selection criteria, were adopted finally. The said adjective term were organized as 5-point Likert scale for the purpose of questionnaire survey and the statistical analysis, moreover those adjective term were classified into 6 groups via the factor analysis, and after discussion with the specialists discussions, which were be named, matched, combined respectively as follows: advanced ←→ ordinary, elegant ←→ meretricious, exquisite ←→ raw, warm ←→ cold, soft ←→ blunt and natural ←→

artificial, thereat, the term difference would be assessed with 5-point scale and the score ranged from strong feeling to no feeling according to the sense. The center score in this scale was 0, and it was extended to both sides respectively including either 1, 2 or -1, -2, thereby, 0 indicated no feeling at all, 2 or -2 indicated a strong feeling, for example: Advanced -2 -1 0 1 2 Ordinary, indicating a strong feeling. A total of 72 questionnaires were distributed and 72 valid questionnaires were recovered with a recovery rate of 100%. In the process of test, subjects were asked to fill in the SD questionnaire at once after looking at the timber sample one by one in an environment of 6000k color temperature in order to understand the visual imagery experienced by the subjects.

3.3. Statistical methods

The statistical methods used in this study to conduct the analysis procedures included Mean, Single Sample T-test and Independent Sample T-test etc., which could be described as follows:

(1) Mean

Mean was used to determine the imagery feeling in this study, firstly in consideration of the statistical presentation, numeric value, therefore, would be transformed from -2 -1 0 1 2 into 1-5, thereat, values obtained from the relevant operations were corresponding to the perception level indicating by the transformed values, so if the mean was smaller than the median 3, its imagery tended to the left side, wherein, the smaller value, the stronger feeling of perception; if the mean was larger than the median 3, its imagery tended to the right side, wherein, the larger value, the stronger feeling of perception, for instance: if the mean for the opposite term of "advanced - ordinary" was 4.36 (M>3), it was indicating a more ordinary feeling.

(2) Single Sample T-test

In this study, Single Sample T-test was utilized to conduct the analysis of mean as well as research samples. Single Sample T-test was adopted to examine whether the mean of the single variable was different from the specified constant. The questionnaire used in this study was a 5-point scale and its specified constant was 3, hence, it would be able to define the boundary of the imagery assessment through the process of a significant test.

(3) Independent Sample T-test

Independent Sample T-test was adopted to compare the mean measured for two different samples. This study was trying to identify the difference of imagery between the tangential with radial section with the Independent Sample T-test.

4. RESEARCH OUTCOMES AND ANALYSES

4.1. Analysis of visual imagery for tree species

In accordance with Table 2 - Single Sample T-test, each tree species, therefore, having a significant adjective term ($p<.05$) could be found that in the first group of imagery term, wherein, the tree species with the "advanced" imagery comprised: the radial section of Cinnamomun micranthum, both the tangential and radial sections of Acacia confusa, the

tangential section of Cyclobalanopsis longinux, the tangential section of Schima superba, the tangential and radial sections of Swietenia mahogoni; and thereat, the tree species with the “ordinary” imagery comprised: the radial section of Michelia formosana, both the tangential and radial sections of Cinnamomum camphora, the tangential section of Cinnamomun micranthum, both the tangential and radial sections of Machilus kusanoi, both the tangential and radial sections of Actinodaphne nantoensis, both the tangential and radial sections of Cassia siamea, both the tangential and radial sections of Schefflera actophylla, the radial section of Alnus formosana, the radial section of Cyclobalanopsis longinux, the tangential sections of Castanopsis carlesii Hay, both the tangential and radial sections of Pasania brevicaudata, the tangential section of Pasania ternaticupula, both the tangential and radial sections of Trema orientalis, the radial section of Fraxinus formosana, both the tangential and radial sections of Paulownia taiwaniana. Among them, the tangential section of Swietenia mahogoni had the most significant "advanced” imagery (M=1.931). And the tangential section of Paulownia taiwaniana had the most significant "ordinary" imagery (M=3.887).

In the opposite imagery of “elegant-meretricious”, whereat, the tree species with the “elegant” imagery feelings comprised: the radial section of Cinnamomun micranthum, both the tangential and radial sections of Acacia confusa, the tangential section of Cyclobalanopsis gilva, the tangential section of Cyclobalanopsis longinux, the tangential section of Zelkova formosana, both the tangential and radial sections of Schima superba, the tangential section of Fraxinus formosana, both the tangential and radial sections of Swietenia mahogoni; in addition, the samples with the “meretricious” feeling comprised: the radial section of Michelia formosana, both the tangential and radial sections of Cinnamomum camphora, both the tangential and radial sections of Machilus kusanoi, both the tangential and radial sections of Actinodaphne nantoensis, both the tangential and radial sections of Cassia siamea, both the tangential and radial sections of Schefflera actophylla, the radial section of Cyclobalanopsis longinux, the tangential radial section of Castanopsis carlesii Hay, both the tangential and radial sections of Pasania ternaticupula, the tangential section of Trema orientalis, and the tangential section of Paulownia taiwaniana. Among them, the tangential section of Swietenia mahogoni had the most significant “elegant” imagery (M=1.944). And the tangential section of Cassia siamea had the most significant "meretricious” imagery (M=3.889).

In the opposite imagery of “exquisite-raw", whereat, the tree species with the “exquisite” imagery feelings comprised: the radial section of Cinnamomun micranthum, both the tangential and radial sections of Acacia confusa, the tangential section of Cyclobalanopsis gilva, the tangential section of Cyclobalanopsis longinux, the radial section of Zelkova formosana, both the tangential and radial sections of Schima superba, the tangential section of Fraxinus formosana, both the tangential and radial sections of Swietenia mahogoni; Moreover, the tree species with the “raw” imagery comprised: the radial section of Cinnamomum camphora, the radial section of Machilus kusanoi, both the tangential and radial sections of Actinodaphne nantoensis, the tangential section of Sasafras randaiense, both the tangential and radial sections of Cassia siamea, both the tangential and radial sections of Schefflera actophylla, the radial section of Cyclobalanopsis gilva, the radial section of Cyclobalanopsis longinux, the tangential section of Castanopsis carlesii Hay, the radial section of Lithocarpus amygdalifolius, the tangential section of Pasania brevicaudata, both the tangential and radial sections of Pasania ternaticupula, the tangential section of

Trema orientalis, and the tangential section of Paulownia taiwaniana. Among them, the tangential section of Swietenia mahogoni had the most significant "elegant" imagery (M=2.014). And the tangential section of Cassia siamea had the most significant "raw" imagery (M=4.000).

In the opposite imagery of "warm-cold", whereat, the tree species with the "warm" imagery feelings comprised: the radial section of Cinnamomun micranthum, the tangential section of Sasafras randaiense, both the tangential and radial sections of Acacia confusa, the tangential section of Cyclobalanopsis gilva, the radial section of Cyclobalanopsis longinux, both the tangential and radial sections of Zelkova formosana, both the tangential and radial sections of Schima superba, the tangential section of Fraxinus formosana, also both the tangential and radial sections of Swietenia mahogoni; in addition, the tree species with the "cold" imagery feelings comprised: the radial section of Michelia formosana, the tangential section of Trochodendron aralioides, both the tangential and radial sections of Machilus kusanoi, both the tangential and radial sections of Actinodaphne nantoensis, both the tangential and radial sections of Schefflera actophylla, the tangential section of Castanopsis carlesii Hay, the tangential section of Pasania ternaticupula, the tangential section of Trema orientalis, the radial section of Fraxinus formosana, and the tangential section of Paulownia taiwaniana. Among them, the radial section of Swietenia mahogoni had the most significant "warm" imagery (M=1.833). And the tangential section of Actinodaphne nantoensis had the most significant "cold" imagery (M=3.625).

In the opposite imagery of "soft-blunt", whereat, the tree species with the "soft" imagery feelings comprised: the radial section of Cinnamomun micranthum, the tangential section of Acacia confusa, the tangential section of Cyclobalanopsis longinux, both the tangential and radial sections of Zelkova formosana, the radial section of Trema orientalis, both the tangential and radial sections of Schima superba, the tangential section of Fraxinus formosana, both the tangential and radial sections of Swietenia mahogoni; in addition, the tree species with the "blunt" imagery feelings comprised: the radial section of Michelia formosana, the tangential section of Trochodendron aralioides, the radial section of Machilus kusanoi, both the tangential and radial sections of Actinodaphne nantoensis, the tangential section of Cassia siamea, the radial section of Cyclobalanopsis gilva, the radial section of Cyclobalanopsis longinux, the radial section of Lithocarpus amygdalifolius, the radial section of Pasania brevicaudata, both the tangential and radial sections of Pasania ternaticupula, the tangential section of Trema orientalis, and the tangential section of Paulownia taiwaniana. Among them, the radial section of Swietenia mahogoni had the most significant "soft" imagery (M=1.986). And the radial section of Actinodaphne nantoensis had the most significant "blunt" imagery (M=3.542).

In the opposite imagery of "natural-artificial", whereat, the tree species with the "natural" imagery feelings comprised: the tangential section of Michelia formosana, both the tangential and radial sections of Acacia confusa, the radial section of Zelkova formosana, the radial section of Trema orientalis, both the tangential and radial sections of Schima superba, the tangential section of Fraxinus formosana, both the tangential and radial sections of Swietenia mahogoni; in addition, the tree species with the "artificial" imagery feelings comprised: the radial section of Michelia formosana, the radial section of Cyclobalanopsis gilva, the radial section of Cyclobalanopsis longinux, and the radial section of Lithocarpus amygdalifolius.

Among them, the radial section of Swietenia mahogoni had the most significant "natural" imagery (M=2.167). And the radial section of Cyclobalanopsis longinux had the most significant "artificial" imagery (M=3.514).

Table 2 –Single Sample T-test on the imagery of tree species

imagery	species name	tangential section			radial section		
		M	T	standard deviation	M	T	standard deviation
advanced	Cinnamomun micranthum	-	-	-	2.625	-2.813**	1.131
	Acacia confusa	2.403	-4.420***	1.146	2.611	-3.014**	1.095
	Cyclobalanopsis longinux	2.708	-2.119*	1.168	-	-	-
	Schima superba	2.361	-4.554***	1.190	-	-	-
	Swietenia mahogoni	1.931	-9.984***	0.909	1.944	-8.670***	1.033
ordinary	Michelia formosana	-	-	-	3.417	3.017**	1.172
	Cinnamomum camphora	3.542	4.040***	1.138	3.389	2.765**	1.193
	Cinnamomun micranthum	3.361	2.391*	1.282	-	-	-
	Machilus kusanoi	3.611	4.578***	1.133	3.764	6.393***	1.014
	Actinodaphne nantoensis	3.764	6.307***	1.028	3.778	6.822***	0.967
	Cassia siamea	3.847	6.018***	1.195	3.528	4.388***	1.021
	Schefflera actophylla	3.542	3.629***	1.266	3.577	3.894***	1.250
	Alnus formosana	-	-	-	3.347	2.736**	1.077
	Cyclobalanopsis longinux	-	-	-	3.292	2.264*	1.093
	Castanopsis carlesii hay	3.750	5.668***	1.123	-	-	-
	Pasania brevicaudata	3.375	2.782**	1.144	3.278	2.187*	1.078
	Pasania ternaticupula	3.500	3.409***	1.245	-	-	-
	Trema orientalis	3.806	6.237***	1.096	3.278	2.112*	1.116
	Fraxinus formosana	-	-	-	3.347	2.612*	1.128
	Paulownia taiwaniana	3.887	8.927***	0.838	3.375	3.149**	1.013
elegant	Cinnamomun micranthum	-	-	-	2.625	-2.877**	1.106
	Acacia confusa	2.458	-3.875***	1.186	2.597	-3.318**	1.030
	Cyclobalanopsis gilva	2.681	-2.412*	1.124	-	-	-
	Cyclobalanopsis longinux	2.569	-3.288**	1.111	-	-	-
	Zelkova formosana	2.681	-2.311*	1.173	-	-	-
	Schima superba	2.208	-6.414***	1.047	2.667	-2.699**	1.048
	Fraxinus formosana	2.611	-2.979**	1.108	-	-	-
	Swietenia mahogoni	1.94	-10.10***	0.886	1.98	-8.26***	1.041
meretricious	Michelia formosana	-	-	-	3.292	2.188*	1.131
	Cinnamomum camphora	3.458	3.457***	1.125	3.306	2.454*	1.057
	Machilus kusanoi	3.333	2.272*	1.245	3.556	4.504***	1.047
	Actinodaphne nantoensis	3.583	4.511***	1.097	3.556	4.755***	0.991
	Cassia siamea	3.889	7.145***	1.056	3.472	4.096***	0.978
	Schefflera actophylla	3.306	2.000*	1.296	3.394	2.664*	1.248
	Cyclobalanopsis longinux	-	-	-	3.389	2.638*	1.251
	Castanopsis carlesii hay	3.667	5.697***	0.993	-	-	-
	Pasania ternaticupula	3.486	3.408**	1.210	3.292	2.164*	1.144
	Trema orientalis	3.736	5.317***	1.175	-	-	-
	Paulownia taiwaniana	3.817	6.853***	1.004	-	-	-
exquisite	Cinnamomun micranthum	-	-	-	2.569	-3.326**	1.098
	Acacia confusa	2.458	-4.568***	1.006	2.556	-3.979***	0.948
	Cyclobalanopsis gilva	2.708	-2.119*	1.168	-	-	-
	Cyclobalanopsis longinux	2.681	-2.265*	1.197	-	-	-
	Zelkova formosana	-	-	-	2.681	-2.106***	1.287
	Schima superba	2.069	-9.000***	0.877	2.423	-4.170***	1.167
	Fraxinus formosana	2.333	-5.397***	1.048	-	-	-
	Swietenia mahogoni	2.014	-9.028***	0.927	2.056	-7.378***	1.086
raw	Cinnamomum camphora	3.306	2.2867*	1.134	-	-	-
	Machilus kusanoi	-	-	-	3.417	3.260**	1.084
	Actinodaphne nantoensis	3.486	3.839***	1.075	3.639	4.799***	1.130
	Sasafras randaiense	3.361	2.654*	1.154	-	-	-
	Cassia siamea	4.000	7.994***	1.061	3.528	4.274***	1.048
	Schefflera actophylla	3.306	2.035*	1.274	3.423	3.263**	1.091
	Cyclobalanopsis gilva	-	-	-	3.403	2.513*	1.360
	Cyclobalanopsis longinux	-	-	-	3.333	2.408*	1.175

imagery	species name	tangential section			radial section		
		M	T	standard deviation	M	T	standard deviation
	Castanopsis carlesii hay	3.472	3.447**	1.162	-	-	-
	Lithocarpus amygdalifolius	-	-	-	3.444	2.979**	1.266
	Pasania brevicaudata	3.431	3.251**	1.124	-	-	-
	Pasania ternaticupula	3.722	5.757***	1.064	3.333	2.632*	1.075
	Trema orientalis	3.903	7.294***	1.050	-	-	-
	Paulownia taiwaniana	3.831	6.811***	1.028	-	-	-
warm	Cinnamomun micranthum	-	-	-	2.583	-3.260**	1.084
	Sasafras randaiense	2.736	-2.035*	1.100	-	-	-
	Acacia confusa	2.264	-5.676***	1.100	2.569	-3.251**	1.124
	Cyclobalanopsis gilva	2.521	-3.138**	1.286	-	-	-
	Cyclobalanopsis longinux	2.306	-5.965***	0.988	-	-	-
	Zelkova formosana	2.282	-5.795***	1.044	1.986	-8.992***	0.957
	Schima superba	2.625	-2.644*	1.204	2.653	-2.704**	1.090
	Fraxinus formosana	2.528	-3.344**	1.198	-	-	-
	Swietenia mahogoni	1.917	-8.687***	1.058	1.833	-9.212***	1.075
cold	Michelia formosana	-	-	-	3.347	2.504*	1.177
	Trochodendron aralioides	3.431	3.053**	1.197	-	-	-
	Machilus kusanoi	3.458	3.044**	1.278	3.625	4.588***	1.156
	Actinodaphne nantoensis	3.625	4.851***	1.093	3.458	3.622***	1.074
	Schefflera actophylla	3.583	3.848***	1.286	3.507	3.732***	1.145
	Castanopsis carlesii hay	3.389	2.527*	1.306	-	-	-
	Pasania ternaticupula	3.319	2.142*	1.265	-	-	-
	Trema orientalis	3.319	2.592*	1.046	-	-	-
	Fraxinus formosana	-	-	-	3.264	2.084*	1.075
	Paulownia taiwaniana	3.443	3.646***	1.016	-	-	-
soft	Cinnamomun micranthum	-	-	-	2.625	-2.877**	1.106
	Acacia confusa	2.444	-4.447***	1.060	-	-	-
	Cyclobalanopsis longinux	2.625	-2.753**	1.156	-	-	-
	Zelkova formosana	2.583	-3.149**	1.123	2.486	-3.790***	1.151
	Trema orientalis	-	-	-	2.486	-4.331***	1.007
	Schima superba	2.153	-6.078***	1.183	2.639	-2.433*	1.259
	Fraxinus formosana	2.319	-5.522***	1.046	-	-	-
	Swietenia mahogoni	2.097	-6.792***	1.128	1.986	-8.055***	1.068
blunt	Michelia formosana	-	-	-	3.403	2.730**	1.252
	Trochodendron aralioides	3.361	2.524*	1.214	-	-	-
	Machilus kusanoi	-	-	-	3.417	2.900**	1.219
	Actinodaphne nantoensis	3.403	2.730**	1.252	3.542	4.179***	1.100
	Cassia siamea	3.431	3.084**	1.213	-	-	-
	Cyclobalanopsis gilva	-	-	-	3.472	3.058**	1.251
	Cyclobalanopsis longinux	-	-	-	3.514	4.108***	1.184
	Lithocarpus amygdalifolius	-	-	-	3.458	3.667***	1.061
	Pasania brevicaudata	-	-	-	3.458	3.578***	1.087
	Pasania ternaticupula	3.472	3.824***	1.048	3.514	4.523***	1.047
	Trema orientalis	3.389	2.765**	1.193	-	-	-
	Paulownia taiwaniana	3.451	3.395**	1.119	-	-	-
natural	Michelia formosana	2.556	-2.904**	1.299	-	-	-
	Acacia confusa	2.458	-3.837***	1.198	2.486	-4.009***	1.088
	Zelkova formosana	-	-	-	2.583	-2.703**	1.308
	Trema orientalis	-	-	-	2.292	-5.497***	1.093
	Schima superba	2.222	-5.663***	1.165	2.528	-3.600***	1.113
	Fraxinus formosana	2.681	-2.142*	1.265	-	-	-
	Swietenia mahogoni	2.292	-5.199***	1.156	2.167	-5.843***	1.210
artificial	Michelia formosana	-	-	-	3.375	2.724**	1.168
	Cyclobalanopsis gilva	-	-	-	3.361	2.063*	1.485
	Cyclobalanopsis longinux	-	-	-	3.514	3.383**	1.289
	Lithocarpus amygdalifolius	-	-	-	3.375	2.594*	1.227

Note: *P< .05 ; **P< .01 ; ***P< .001

4.2. Analysis of visual imagery for the material sections

In this section, the present study would like to analyze the visual imagery for the tangential or radial section cut from the common used timbers respectively, and while conducting the process of mean, Single Sample T-test as well as Independent Sample T-test, thereat, the relevant analysis results could be described as follows:

(1) Analysis of visual imagery for the tangential sections

Visual imagery for the tangential section of each tree species, it could be found, therefore, that “Michelia formosana" had the natural imagery. “Trochodendron aralioides" had the cold and blunt imagery. “Cinnamomum camphora" had the ordinary and meretricious imagery. “Cinnamomun micranthum" had the ordinary imagery. “Machilus kusanoi" had the ordinary, meretricious and cold imagery. “Actinodaphne nantoensis" had the ordinary, meretricious, raw, cold and blunt imagery. “Sasafras randaiense" had the raw and warm imagery. “Cassia siamea" had the ordinary, meretricious, raw and blunt imagery. “Acacia confusa" had the advanced, elegant, exquisite, warm, soft and natural imagery. “Schefflera actophylla" had the ordinary, meretricious, raw and cold imagery. “Cyclobalanopsis gilva" had the elegant, exquisite and warm imagery. “Cyclobalanopsis longinux" had the advanced, elegant, exquisite, warm and soft imagery. “Castanopsis carlesii Hay" had the ordinary, meretricious, raw and cold imagery. “Pasania brevicaudata" had the ordinary and raw imagery. “Pasania ternaticupula" had the ordinary, meretricious, raw, cold and blunt imagery. “Zelkova formosana" had the elegant, warm and soft imagery. “Trema orientalis” had the ordinary, meretricious, raw, cold and blunt imagery. “Schima superba" had the advanced, elegant, exquisite, warm, soft and natural imagery. “Fraxinus formosana" had the elegant, exquisite, warm, soft and natural imagery. “Paulownia taiwaniana" had the ordinary, meretricious, raw, cold and blunt imagery. “Swietenia mahogoni" had the advanced, elegant, exquisite, warm, soft and natural imagery.

Additionally, as to the problem regarding whether the visual imagery for the tangential section of each tree species was significant or not, it could be found through Single Sample T-test, that there were no significance for the imagery term related to the tangential section at all.

(2) Analysis of visual imagery for the radial sections

Visual imagery for the radial section of each tree species, it could be found, therefore, that "Michelia formosana" had the ordinary, meretricious, cold, blunt and artificial imagery. “Cinnamomum camphora" had the ordinary, meretricious and raw imagery. “Cinnamomun micranthum" had the advanced, elegant, exquisite, warm and soft imagery. “Machilus kusanoi" had the ordinary, meretricious, raw, cold and blunt imagery. “Actinodaphne nantoensis" had the ordinary, meretricious, raw, cold and blunt imagery. “Cassia siamea" had the ordinary, meretricious, raw and blunt imagery. “Acacia confusa" had the advanced, elegant, exquisite, warm and natural imagery. “Schefflera actophylla" had the ordinary, meretricious, raw and cold imagery. “Alnus formosana” had the ordinary imagery. “Cyclobalanopsis gilva" had the raw, blunt and artificial imagery. “Cyclobalanopsis longinux" had the ordinary, meretricious, raw, blunt and artificial imagery. “Lithocarpus amygdalifolius" had the raw, blunt and artificial imagery. “Pasania brevicaudata" had the ordinary and blunt imagery. “Pasania ternaticupula" had the meretricious, raw and blunt imagery. “Zelkova formosana" had the exquisite, warm, soft and natural imagery. “Trema orientalis” had the ordinary, soft and natural imagery. “Schima superba" had the elegant, exquisite, warm, soft and natural imagery. “Fraxinus formosana" had the ordinary and cold imagery. “Paulownia taiwaniana" had the ordinary imagery. “Swietenia mahogoni" had the advanced, elegant, exquisite, warm, soft and natural imagery.

Furthermore, as to the problem regarding whether the visual imagery for the radial section of each tree species was significant or not, it could be found through Single Sample T-test, that there were no significance for the imagery term related to the radial section at all.

(3) Difference of imagery between the tangential and radial sections

The next, while surveying whether the imagery feeling for either the tangential or radial section was significant or not, it could be found clearly that there was no significant difference existing between the tangential and radial sections of broad-leaved trees through the Independent Sample T-test.

5. CONCLUSION

This study adopted 23 kinds of Taiwan's commercial timber materials as the measured samples, and utilized the Semantic Differential questionnaire as well as the statistical methods to study the consumers' mental experiences of the commercial hardwood (broad-leaved tree) materials from Taiwan with the conclusion as follows:

(1) Among Taiwan's commercial timber materials, wherein, the advanced, elegant, and exquisite imagery are related to the tangential section of Swietenia mahogoni; and the warm, soft, and natural imagery are related to the radial section of Swietenia mahogoni; in addition, the ordinary imagery is then related to the Paulownia taiwaniana's tangential section; and the meretricious, and raw imagery are related to the tangential section of Cassia siamea; and moreover, the cold, and blunt imagery are related to both the tangential and radial sections of Actinodaphne nantoensis; thereat, the artificial imagery is related to the Cyclobalanopsis longinux thereof. (2) In terms of the imagery for the sections of timbers, there is no significant difference existing between the tangential or radial section of the broad-leaved trees.

In addition, this study is focusing on the measured samples of Taiwan's commercial hardwood materials only, and hoping it can be provided as a valuable reference for the relevant researches, thus, it is expected that the relevant follow-up researches in the future may further survey the imagery of conifers or compare the difference of imagery between the conifers and broad-leaved trees etc., and in this way it will be able to make the people have a better understanding of Taiwan's commercial timbers, and also be able to apply the imagery feelings to the culture industry or design creations.

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