

STUDY ON THE EVALUATION OF IMPRESSION IN STREETSCAPES IN ALGERIA AND JAPAN USING KANSEI ENGINEERING

感性工学を利用した日本とアルジェリアの街路景観構成の印象評定に関する研究

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This study aims to explore the semantic attributes of a dataset composed of 74 streetscape images collected in Algeria and Japan. Authors collected and evaluated human judgmental responses using SD method as a tool of Kansei engineering in order to provide information about human perception of the visual attributes of the collected images. The research process included: (1) Semantic selection of bipolar adjective pairs. (2) Psychological evaluation of the visual stimuli using a questionnaire of 40 adjectives presented in French and Japanese. (3) Semantic evaluation of the participants' rating using factor analysis, cluster analysis and analysis of variance (ANOVA). The results showed that: (1) The semantic space was described by three independent axes which explained 79.80% of the variability. (2) Low correlation between the impressions of Algerian and Japanese participants in both Algerian and Japanese streetscapes. (3) Differences in the distribution of responses among the 7-point scale and also in the number of axes. And (4) Gender differences showed small differences in the axis of activity that represent less than 0.74% of explained variance.

Keywords: *Semantic Differential Method, Kansei Engineering, Visual Impression, Evaluation of impression*
SD法, 感性工学, 視覚印象, 印象評定

1. Introduction

A Street is not simply a space along which pedestrians move. It is a substantial part of the urban environment, in which daily human activities take place. It represents an essential part of the outdoor environment, together with buildings and natural scenery, and a key element of townscape¹⁾. First, because streets are an essential factor for creating the attractiveness of a town as it depends greatly on the views from the street. Second, because of their effects on the well-being of pedestrians.

The question in this research is about how participants judge or perceive streetscapes and why is a street "A" more complex or more preferred than a street "B"? Llinares suggested that participants in environmental psychology experiments respond to the characteristics of the physical environment by integrating these reactions into emotional impressions and then transform these emotional impressions into an aesthetic evaluation²⁾.

Literature review revealed multiple approaches to study the affective and

cognitive appraisal in urban streetscapes. Kansei engineering is one of these approaches used to quantify perception. According to the Japanese dictionary Shin Meikai, Kansei is an "intuitive mental action of the person who feels some sort of impression from an external stimulus". It is similar to psychology in terms of grasping the image that exists in a person's mind. It transforms this image into something measurable³⁾. Nagamachi in his studies explains this concept by articulating that "Kansei is an individual's subjective impression from a certain artifact, environment or situation"⁴⁾.

Kansei Engineering was applied in different studies on the affective attributes, which are relevant in the evaluation of streetscapes. Based on Kansei engineering, Appleyard (1981) argued in his research that residents structured their values of streets into four principal dimensions: street as sanctuary, child-rearing, accessibility and neighborhood identity⁵⁾. Llinares (2008) analyzed the dependence of the selection of a living place within a city from the perception of their respective urban landscapes⁶⁾, and Nakama

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(2010) used Kansei engineering to study the impression of Kyoto city streetscapes⁷⁾. In 2006, Kinoshita introduced Kansei stroll map that visualizes streetscape impressions to help users finding less-known places and streets that match their interests⁸⁾, and Tsuchiya (2013) used KE to analyze people's subjective responses towards a streetscape plan with a historical townscape⁹⁾.

Semantic differential is one of the Kansei engineering tools, which was used mostly in streetscape studies. It was first developed by Osgood in 1951. It is a type of rating scale designed for observing and measuring the psychological meanings of concepts on a scale between two bipolar words or adjectives¹⁰⁾. It has proven to be a flexible and reliable instrument for measuring attitudes to a wide range of stimuli. Semantic differential method was used in this research in order to grasp the emotional impressions of two groups of subjects, Japanese and Algerian, regarding complexity and preference in a dataset of streetscapes collected in Algeria and Japan.

2. Aims

The aim of the present study is the semantic evaluation of the visual attributes of a dataset composed of 74 streetscape images. It focuses on the emotional impressions of the participants who evaluated the visual richness of the dataset. The aim was to: (1) Analyze the participants' emotional responses towards the different compositions of the streetscapes. (2) Study the semantic differences between Algerian and Japanese streetscapes. And (3) to investigate the gender and culture differences in judgmental responses.

3. Area of the study

Because of data availability and previous experience in the subject, authors selected Algeria and Japan as the main areas of this study. Nonetheless, lack of resources and time limits prevented the authors from covering a large number of cities in both countries.

To avoid misleading generalization of the results that will issue from this study, authors based the collection of streetscape images on the idea of selecting two cities from each country in which the data collection would be feasible. Since this research is focused on streetscape composition, the size

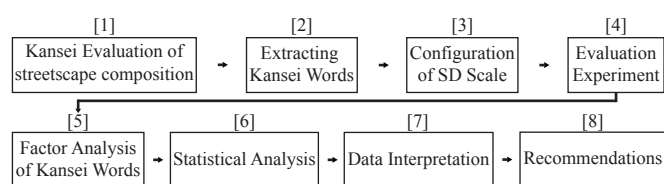


Fig.1 Procedure of the research design

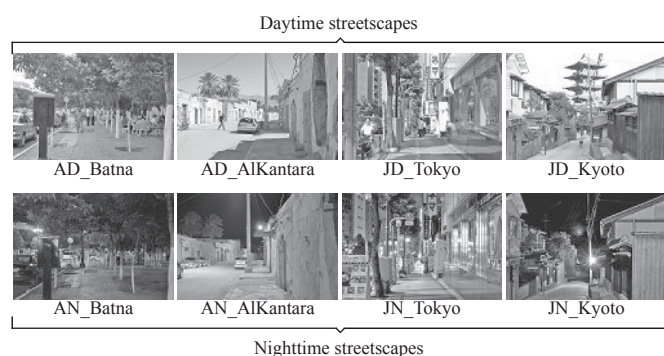


Fig.2 Example of streetscape images

and scale of each city were not considered as the primary and basic criterions¹¹⁾. Streetscape images were collected from (1) Tokyo and Batna cities because they offer different urban landscapes with aspects of modernity. (2) Kyoto and Al-Kantara cities because they include more traditional built environments.

In Tokyo, streetscape images were shot in the districts of Shibuya, Harajuku and Meguro. Shibuya is known as a center of Information Technology in Japan with streets full of fashion stores, restaurants and department stores. Harajuku streets include many landmarks, small fashion stores, fast food restaurants and so forth. Meguro represents a residential district with hilly landscape, situated in the southwestern part of Tokyo. Streetscape images collected in Kyoto city were shot in Gion, which represents a preserved historic district in Higashiyama Ward. Its Architecture is mainly traditional and dates back to Edo period.

In Batna city, which is located on the high plains of eastern Algeria, streetscape images were collected in the "Stand" district. This district was mainly built for French colons during the colonial period. It is characterized morphologically by an orthogonal grid where straight streets define a series of regular urban blocks. Streetscape images collected in the town of Al-Kantara, located in the north of Biskra prefecture, were taken in "village rouge" and "village Blanc". The Architecture in these areas is mainly vernacular with few French colonial buildings.

The photographs were shot in daytime and nighttime because changes in the distribution of light influence the perception and interpretation of space¹²⁾. Specifically, dim light was found to decrease the perceived size of objects, ornaments and the overall built environment¹³⁾.

The present study focuses on the composition of streetscapes, which is generated from the superposition of different profiles (street space, architectural variety of buildings, ground, sky, street elements like signage and furniture, human activity, trees, etc.) and their connectedness.

4. Research design

The purpose of this study was to carry out the first phase of Kansei

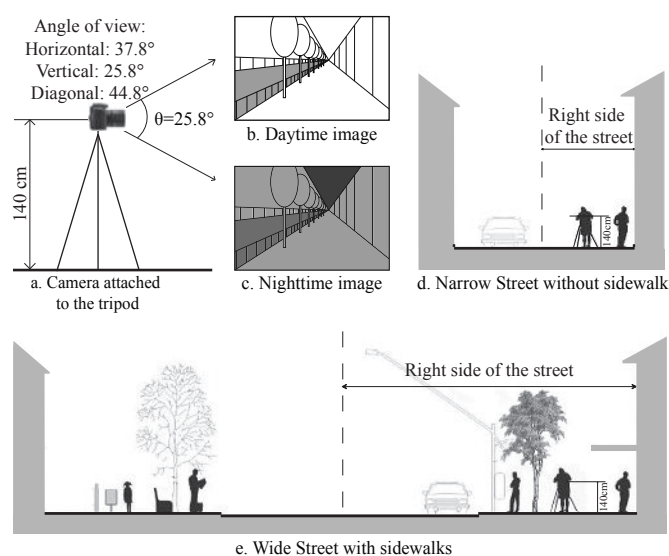


Fig.3 Data collection method

methodology to analyze the participants' emotional responses toward streetscape composition. With regard to the aim, this research used Kansei procedure following the standard process established by Nagamachi^{3,9)}, which included an evaluation experiment followed by statistical analysis of the obtained data. The most common process involves three main steps: (1) selection of Kansei words, (2) Kansei evaluation experiment using a questionnaire and (3) multivariate analyses of the data obtained from the evaluation experiment (e.g. factor analysis) (Fig. 1).

5. Data collection

The dataset used in this study was composed of 74 streetscape images. 37 images were shot in Al-Kantara and Batna cities. The other 37 images were taken in the cities of Kyoto and Tokyo (Fig. 2). Within the dataset, 40 images were acquired in daytime and 34 images in nighttime using a digital camera Nikon D300S with Nikkor lens system AF-S DX 35mm f/1.8G. All images were taken during summer season in two phases. The first phase was done in Algeria between the 17th and the 19th of June 2010. The second phase was done in Japan between the 4th and the 5th of August 2010. The camera was fixed on a tripod in order to avoid artifacts caused by camera shaking (Fig. 3). All images were shot from the right side of each street to avoid heterogeneity in the vision fields. The image resolution was 4288 x 2848 pixels with a quality of 14 bits/pixel. The original set of images was converted to JPEG format using Nikon ViewNx 2 software, with "Highest Compression Ratio" settings.

6. Methods

6.1. Participants

Two categories of subjects were involved in this study. The first category included 20 Japanese students in the department of architecture of Nagoya institute of technology (13 males and 7 females), with an average age of 23 years old. The second category was composed of 13 Algerian students at Batna University (six males and seven females) with an average age of 27 years old. Subjects from both countries were mainly master's students in Architecture in order to ensure homogeneity between the two groups. Among the 33 subjects, five Algerian subjects were excluded because they did not respond to all adjectives in the questionnaire. Three Japanese subjects were also excluded because their distribution rates were very low, which made the data commonness very low compared to other participants (Fig 4).

The whole sample included the same number of males and females, but more Japanese than Algerian participants (71.43%, 28.57% respectively). It should be noticed that it was not possible to ensure the same number of Algerian and Japanese participants. This was due to time limits and unfeasibility of conducting the same experiment in Algeria compared to Japan.

6.2. Procedure

Images in the dataset were presented to subjects in RGB format using a large high resolution display Dell UltraSharpTM 3008WFP 760. The distance between each participant and the display was about 80 cm (Fig. 5). Each participant evaluated different random order of streetscape images in order to avoid misjudgments of the last images in the dataset. The concept of

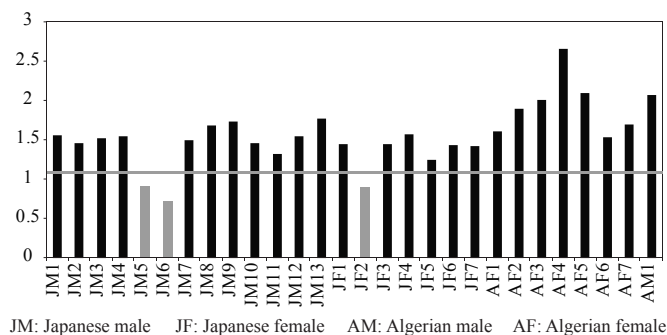


Fig.4 Standard deviation of the evaluation of all participants



Fig.5 Participant evaluating streetscape images

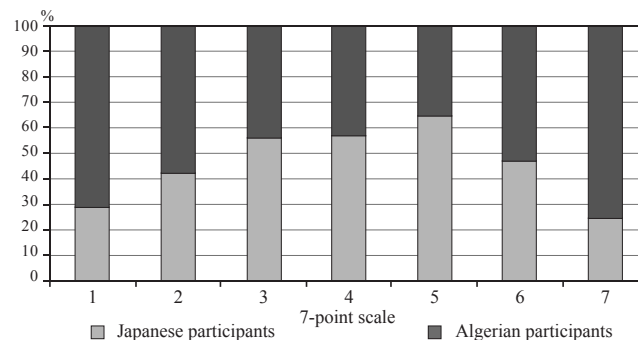


Fig.6 Evaluation of streetscapes according to Japanese & Algerian participants

composition was defined in this paper and explained to the subjects as being the connectedness among five classes that compose a streetscape, which are: buildings, vegetation, sky, ground and actors (human activity, vehicles and furniture). Authors explained the aim of the experiment and asked each one of the subjects to estimate the visual attributes of each streetscape image. Subjects were confronted with stimulus material and marked the seven-point scale between a polar pair, presumably in accordance with some kind of internal reaction towards the stimulus material¹⁴⁾.

6.3. Questionnaire

Participants filled in a questionnaire sheet that included 40 bipolar pair adjectives, organized according to a seven-point SD scale (from 1 to 7). The bipolar adjectives were selected after conducting a preliminary inquiry about commonly used adjectives to describe complexity and preference in the study of streetscapes. These adjectives were selected as follows: First, 80 English adjectives were collected from the most frequent terms, used by designers in the description of the built environment¹⁵⁾. Second, the number of selected adjectives was reduced to 60 after excluding adjectives with similar meanings. Authors made a second inquiry in order to find the adequate Japanese translation of the selected English adjectives, by searching in the published Japanese papers about SD method. Finally, the number was

Table 1 Results of factor analysis

Axes	Label	Adjectives	Factor 1	Factor 2	Factor 3
1st Axis	Pleasantness and Affinity	Attractive — Repulsive	0.96	0.12	0.15
		Preferred — Undesirable	0.95	0.16	0.18
		Like — Hate	0.94	0.24	0.13
		Beautiful — Ugly	0.94	0.05	0.23
		Warm — Cold	0.94	-0.01	0.06
		Relaxed — Tence	0.93	0.11	0.15
		Friendly — Distant	0.93	0.23	0.14
		Cozy — Uncomfortable	0.93	0.20	0.24
		Interesting — Boring	0.92	0.22	-0.05
		Pleasant — Offensive	0.91	0.23	0.29
		Soft — Hard	0.87	-0.06	0.17
		Peaceful — Disturbing	0.86	0.11	0.27
		Harmonious — Ingongruous	0.83	-0.18	0.42
		Safe — Dangerous	0.73	0.58	0.13
		Cheerful — Dismal	0.68	0.67	0.04
		Rich — Poor	0.66	0.58	-0.03
		Natural — Artificial	0.63	-0.48	0.10
		Coherent — Disjoint	0.63	-0.36	0.59
		Deep — Shallow	0.60	-0.39	-0.09
		Intelligible — Unclear	0.54	0.49	0.51
2nd Axis	Complexity and Activity	Dynamic — Static	0.05	0.96	-0.10
		Lively — Calm	-0.12	0.94	-0.11
		Noisy — Quiet	-0.30	0.91	-0.12
		Vivid — Dull	0.36	0.88	-0.01
		New — Old	-0.26	0.85	0.13
		Rhythmic — Loose	0.10	0.85	0.02
		Active — Passive	0.37	0.84	-0.11
		Sophisticated — Rustic	0.14	0.74	0.15
		Various — Monotonous	0.38	0.71	-0.29
		Light — Heavy	0.07	0.63	0.14
		Open — Close	0.30	0.62	0.50
		Clear — Ambiguous	0.26	0.58	0.36
		Complex — Simple	0.24	0.58	-0.49
		Strong — Weak	0.44	0.58	-0.14
3rd Axis	Regularity	Regular — Irregular	0.13	0.00	0.86
		Neat — Messy	0.47	-0.34	0.78
		Orderly — Cluttered	0.49	-0.31	0.74
		Organized — Disarranged	0.53	0.08	0.70
		Broad — Narrow	-0.03	0.50	0.62
Eignvalue			15.69	11.20	5.03
Contribution Ratio (%)			39.22	28.01	12.58
Cumulative Contribution Ratio (%)			39.22	67.23	79.80
Cronbach alpha			0.98	0.96	0.89
Extraction Method: Principal Axis Factoring.					
Rotation Method: Varimax with Kaiser Normalization.					

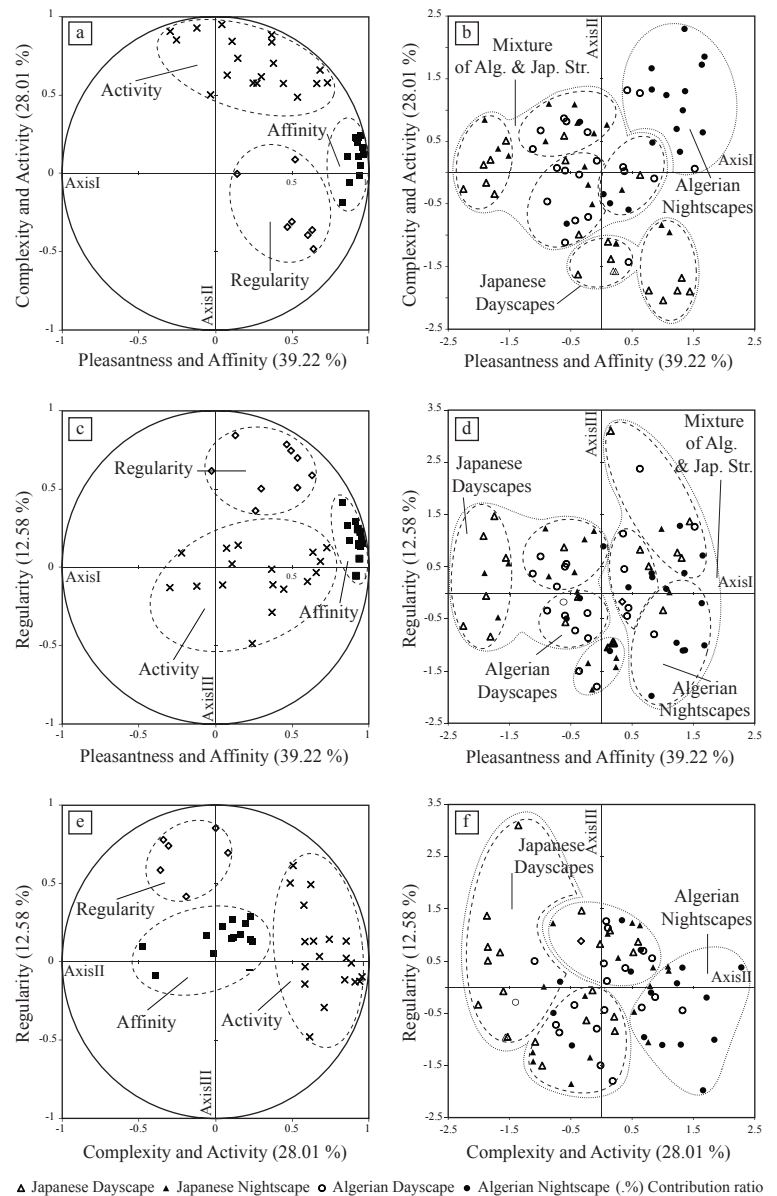


Fig.7 Cognitive clustering of adjectives and streetscapes using Ward method

whittled down to 40 Japanese adjectives, after asking four Japanese students to eliminate the most incomprehensible and ambiguous adjectives. Then, adjectives were translated to French language for Algerian participants, because of their education background.

7. Results and discussion

7.1. Descriptive statistics of the dataset

Figure 6 shows a dissimilarity in the distribution among the seven-point scales after comparing the evaluations done by Japanese and Algerian participants. Algerian participants tend to be more direct and frank in their evaluation. That is why the percentages of the first and the seventh scales were high compared to Japanese participants' evaluation which was more concentrated from the third to the fifth scale.

7.2. Factor Analysis

Principal axis factoring with Varimax rotation was the selected method to

analyze the factorial structure of the semantic scoring related to the cognitive appraisal. The resulting factor scoring was classified into different clusters using cluster analysis (Ward method). The results showed that the perception of the collected streetscapes could be expressed through three independent factors, which explained 79.80% of the variance in the sampled perception (Tab. 1). These three semantic axes represent concepts related to: (1) pleasantness and affinity (Fig. 7a, 7b), (2) complexity and activity (Fig. 7c, 7d) and (3) regularity (Fig. 7e, 7f). The reliability of the obtained axes has been statistically tested using Cranach's alpha coefficient (above 0.7 in all axes).

Factor analysis was performed for each group of participants separately to find the differences between the evaluation of Algerian and Japanese participants. Table 2 and figure 8 show the designation of factorial axes. Figure 9.A shows the factor results of Japanese participants and Figure 9.B shows the factor results of Algerian participants.

From both analyses, we can notice that the difference between both

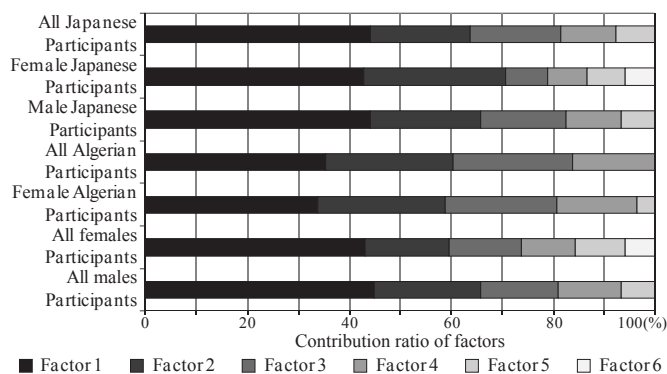


Fig.8 Differences between semantic axes

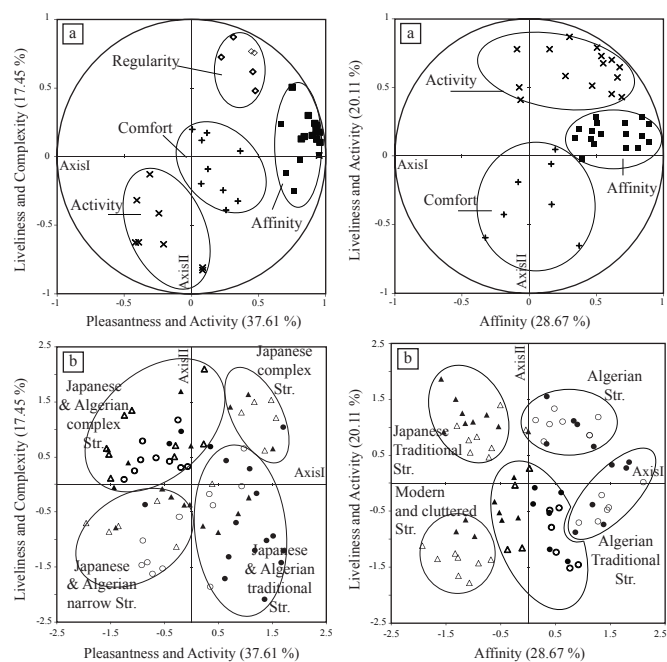


Fig.9 A Japanese daytime str. ▲ Japanese nighttime str.
● Algerian daytime str. ● Algerian nighttime str.
(%) Contribution ratio

Fig.9 Differences between semantic axes for (A) Japanese participants and (B) Algerian participants

Table 3 Correlation coefficients between Algerian and Japanese streetscapes

Correlations	Tokyo daytime	Tokyo nighttime	Kyoto daytime	kyoto nighttime
Batna daytime str.	-0.09	0.30	0.40	0.21
Batna nighttime str.	-0.06	0.37	0.47	0.34
Alkantara daytime str.	<u>-0.65</u>	-0.14	<u>0.66</u>	<u>0.58</u>
Alkantara nighttime str.	<u>-0.65</u>	-0.19	0.45	0.43

Algerian str.	Batna nighttime str.	Alkantara nighttime str.	Japanese str.	Tokyo nighttime str.	kyoto nighttime str.
Batna daytime str.	<u>0.90</u>	<u>0.61</u>	Tokyo daytime str.	<u>0.67</u>	-0.20
Alkantara daytime str.	<u>0.67</u>	<u>0.91</u>	Kyoto daytime str.	0.35	<u>0.94</u>

Table 4 Correlation coefficients between Algerian and Japanese impressions

Correlations	Algerian participants		Japanese participants	
	Algerian str.	Japanese str.	Algerian str.	Japanese str.
Algerian participants	Algerian str.	1	-	-
	Japanese str.	0.31	1	-
Japanese participants	Algerian str.	-0.08	0.02	1
	Japanese str.	0.18	0.20	0.23

Table 2 Designation of factorial axes for Japanese and Algerian participants

Axes	Japanese Participants		Algerian Participants		Axes
	Label	Adjectives	Adjectives	Label	
Axis 1	Pleasantness / Affinity	37 ¹ Relaxed-Tence	16 ¹ Rich-Poor	Affinity	Axis 1
		38 ¹ Warm-Cold	3 ¹ Complex-Simple		
		2 ¹ Friendly-Distant	31 ¹ Interesting-Boring		
		19 ¹ Cozy-uncomfortable	13 ¹ Various-Monotonous		
		39 ¹ Attractive-Repulsive	26 ¹ Strong-Weak		
		20 ¹ Preferred-Undesirable	18 ¹ Beautiful-Ugly		
		29 ¹ Like-Hate	39 ¹ Attractive-Repulsive		
		8 ¹ Pleasant-Offensive	29 ¹ Like-Hate		
		18 ¹ Beautiful-Ugly	20 ¹ Preferred-Undesirable		
		36 ¹ Soft-Hard	32 ¹ Rhythmic-Loose		
Axis 2	Livelihood / Complexity	31 ¹ Interesting-Boring	9 ¹ Sophisticated-Rustic	Livelihood / Activity	Axis 2
		4 ¹ Peaceful-Disturbing	33 ¹ Vivid-Dull		
		25 ¹ Safe-Dangerous	28 ¹ Cheerful-Dismal		
		1 ¹ Harmonious-Incongruous	5 ¹ Noisy-Quiet		
		10 ¹ Natural-Artificial	15 ¹ Lively-Calm		
		28 ¹ Cheerful-Dismal	6 ¹ Broad-Narrow		
		16 ¹ Rich-Poor	17 ¹ Open-Close		
		35 ¹ Intelligible-Unclear	30 ¹ New-Old		
		21 ¹ Neat-Messy	27 ¹ Active-Passive		
		3 ¹ Complex-Simple	11 ¹ Dynamic-Static		
Axis 3	Activity	13 ¹ Various-Monotonous	23 ¹ Deep-Shallow	Comfort	Axis 3
		12 ¹ Orderly-Cluttered	10 ¹ Natural-Artificial		
		14 ¹ Coherent-Disjoint	35 ¹ Intelligible-Unclear		
		7 ¹ Regular-Irregular	25 ¹ Safe-Dangerous		
		11 ¹ Dynamic-Static	22 ¹ Rough-Smooth		
		34 ¹ Organized-Disarranged	36 ¹ Soft-Hard		
		5 ¹ Noisy-Quiet	38 ¹ Warm-Cold		
		15 ¹ Lively-Calm	40 ¹ Light-Heavy		
		26 ¹ Strong-Weak	37 ¹ Relaxed-Tence		
		27 ¹ Active-Passive	2 ¹ Friendly-Distant		
Axis 4	Sophistry	33 ¹ Vivid-Dull	19 ¹ Cozy-uncomfortable	Regularity	Axis 4
		23 ¹ Deep-Shallow	8 ¹ Pleasant-Offensive		
		40 ¹ Light-Heavy	4 ¹ Peaceful-Disturbing		
		24 ¹ Clear-Ambiguous	21 ¹ Neat-Messy		
		30 ¹ New-Old	12 ¹ Orderly-Cluttered		
		32 ¹ Rhythmic-Loose	7 ¹ Regular-Irregular		
		9 ¹ Sophisticated-Rustic	34 ¹ Organized-Disarranged		
		22 ¹ Rough-Smooth	14 ¹ Coherent-Disjoint		
		6 ¹ Broad-Narrow	1 ¹ Harmonious-Incongruous		
		17 ¹ Open-Close	24 ¹ Clear-Ambiguous		

Scale of evaluation

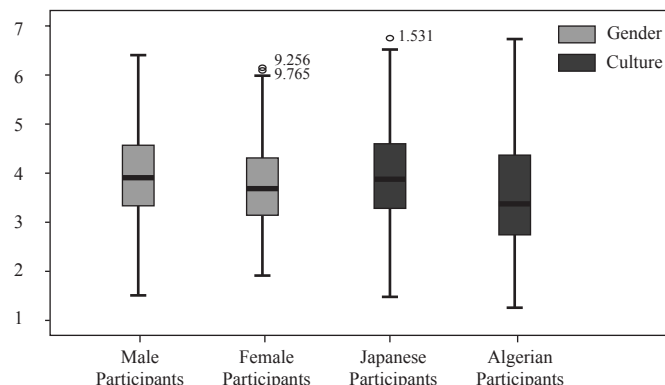


Fig.11 Boxplots of gender and cultural evaluation differences

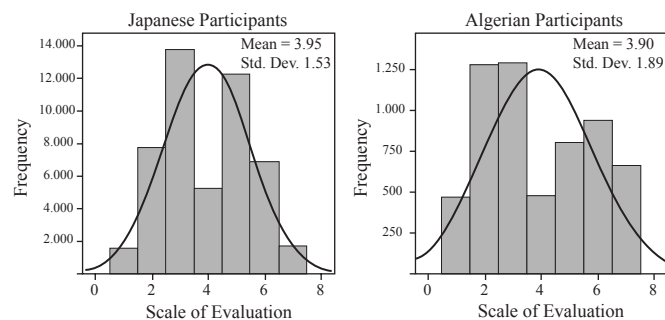


Fig.12 Distribution rates of Algerian and Japanese evaluation

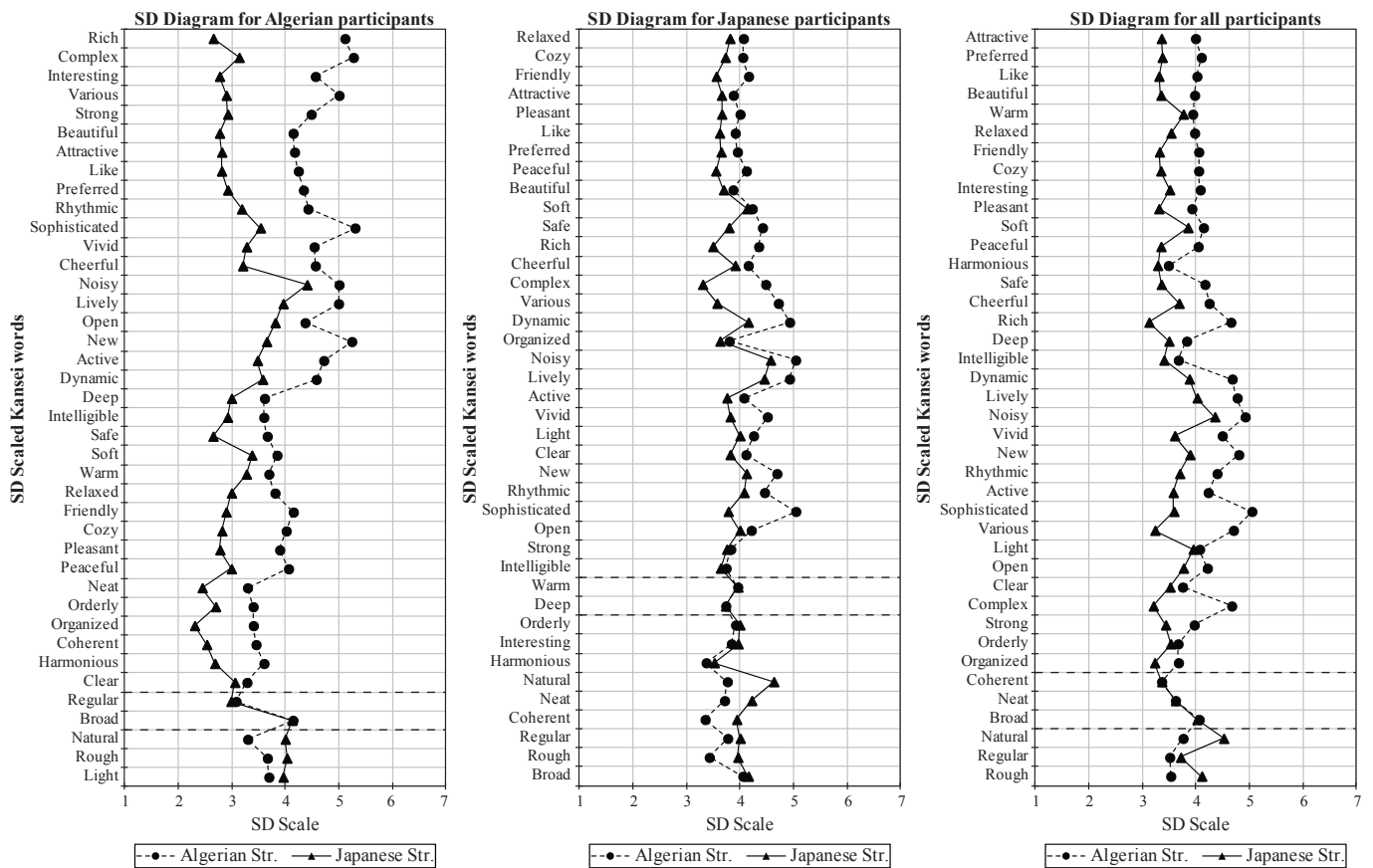


Fig.10 Mean evaluation scores for Algerian, Japanese and all participants

evaluations resides in the number of factorial axes, their contribution ratio and in the order of adjectives among the factors. It should be noticed that Japanese participants tended to like relaxed, cozy and friendly streetscapes, while Algerian participants tended to like complex, rich and various streetscapes. The difference in their impressions may be due to cultural and contextual differences between both countries.

7.3. Analysis of Semantic Differential Evaluation

Figure 10 shows the arithmetic mean distribution related to Japanese and Algerian streetscapes as evaluated respectively by Algerian participants, Japanese participants and all participants together. By observing the characteristics of Japanese streetscapes, the scores were high for many Kansei words, such as: rich, complex, various, vivid, interesting, beautiful, attractive, preferred, coherent and organized. These semantic meanings depend on the variety within the composition of Japanese streetscapes (architectural style, amount of details, street furniture and signage as well as human activity). On the other hand, Algerian streetscapes did not reflect many characteristics and their images were: natural, regular, harmonious, simple, quiet and rustic. Their related semantic meanings reflect the simplicity that characterizes the composition of Algerian streetscapes (architectural style, absence of vegetation, street furniture and signage).

By comparing the evaluation of impressions done by all participants, Al-Kantara daytime and nighttime streetscapes: (1) correlated negatively with Tokyo daytime streetscapes, this was due to the factor of modernity which

characterizes the collected streetscapes in Tokyo. (2) Correlated positively with Kyoto daytime and nighttime streetscapes, because both of them represent traditional streetscapes. However, daytime streetscapes highly correlated with nighttime streetscapes in the four cities (Tab. 3).

7.4. Analysis of differences for culture and gender variables

Cultural differences were tested by comparing between the mean scores of Algerian and Japanese participants for each extracted semantic axis, using ANOVA analysis and Pearson correlation. The results showed that Japanese participants tended to prefer “relaxed” streetscapes while Algerian participants tended to prefer more complex streetscapes. Algerian participants showed frankness and directness in their evaluation compared to Japanese participants. The interpretation of the results showed: (1) No significant differences between Algerian and Japanese, male and female impressions at the $p < 0.05$ level. (2) Low correlation (0.02~0.31) between Algerian and Japanese impressions in both Algerian and Japanese streetscapes (Tab. 4). (3) Differences in the distribution of responses among the SD 7-point scale and also in the number of axes (Fig. 11, 12). And (4) differences in the order and number of factors (Tab. 2).

In terms of gender differences, the analysis could not find significant differences in the evaluation between male and female participants.

8. Conclusion

This study aimed to semantically evaluate the visual attributes of a dataset

composed of 74 streetscape images collected from different locations, both in Algeria and Japan. Semantic differential method was applied as a Kansei Engineering tool in order to grasp the psychological meanings of concepts related to complexity and preference in the dataset, and evaluated by two groups of subjects, Japanese and Algerian.

The findings of this research could reflect three main factorial axes that summarize the semantic attributes of the selected streetscapes and explains 79.8% of the variance. These axes covered pleasantness, complexity and regularity. The semantic attributes of Algerian streetscapes covered simplicity, regularity, naturalness, quietness and rusticity while the semantic attributes of Japanese streetscapes reflected richness, complexity, variety, vividness, attractiveness and interestingness.

In terms of cultural differences, Japanese participants tended to prefer relaxed, cozy and friendly streetscapes while Algerian participants tended to appreciate more complex, rich and various streetscapes. Also, Algerian participants showed frankness and directness in their evaluation compared to Japanese participants. In terms of gender differences, the analysis could not find significant differences in the evaluation between male and female participants.

In General, studies in Kansei Engineering link SD method with industrial design more than urban design. Such Kansei applications in the field of streetscape research proved its relevance according to the literature review. This research attempted to apply this technique in the study of the visual composition of streetscapes with the aim of providing knowledge of how streetscapes are perceived using semantic profiles. This can help in decision making related to which factorial axis to modify via design or which specific design a street must have to create a certain impression.

In terms of research limitations, authors believe that the findings of this study cannot be generalized for streetscapes from other cities because this research was not able to cover a large number of cities in both countries due to time limits and lack of sufficient resources.

Future studies will attempt to identify which streetscape components affect human affective responses. This relationship between design components and semantic attributes could be identified by applying statistical treatments such as linear regression, neural networks or fuzzy logic^{3,4)}.

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和文要約

本研究ではアルジェリアと日本で収集した74枚の街路景観画像から意味属性を明らかにする事を目的とする。

研究の手順は次の通りである。

(1) 日本とアルジェリアの街路40箇所（日本：20箇所、アルジェリア：20箇所）において、74枚の写真を収集した。期間は、2010年6月から8月である。

(2) 評価実験は、まず、2012年6月に日本人20人を対象として、日本で実施した。次に、2012年12月にアルジェリア人13人を対象として、アルジェリアで実施した。

これらの画像に関連する視覚属性に対する参加者の認識を把握するために、感性工学の手法であるSD法を用いて評価した。

研究内容は次の通りである。

(1) Bi-polar（両極）となる評定尺度の決定
(2) 40個の形容詞を用いた評価尺度による心理学的評価を行った
(3) 因子、クラスタおよびANOVA分析を用いて参加者のセマンティック評価を行った。

研究結果は次の通りである。

(1) セマンティックスペースは三つの軸で構成され、これから79.80%の統計的ばらつきが得られた。本研究結果は、今後の印象的な街路設計を決定するために有用である。

(2) アルジェリアと日本の街路景観の両方でアルジェリアと日本の被験者の印象の間には相関が低い。

(3) 7点満点間の反応の分布や軸の数が異なる。

(4) 性別の違いはActivityの軸に0.74%未満の分散の割合というわずかな違いを示した。