

The Research Related to *KANSEI* Stimulation Elements in Cyber-Space

Oh Gi-Dong

Department of Media Architecture
Future University – Hakodate

Abstract

The word “cyber-space” was coined through the developments in communication technology and computers. It became possible to experience disembodied space in practice through a new kind of medium. This research aims to clarify the *kansei* stimulation elements as realistic sensed by users who use 3-dimensional expressions in cyber-space. The research was carried out by preparing 25 samples of computer graphics, and administering 3 questionnaires to 12 examinees. The Principal Ingredient Analysis method was used for its analysis and assessment. As a result of this research, it can be concluded that materials, reflection and shadow have the strongest effect on human beings’ senses in cyber-space.

Keyword : Relate, KANSEI, Cyber - Space

1.1 Introduction

Generally, most humans have 5 senses: sight, hearing, touch, taste and smell. All of these senses are stimulated from the outside, and transmitted to the cerebrum through the central nervous system. The cerebrum manages information processing, and this entire process of human response, is called *kansei* in Japanese. (reference 1).

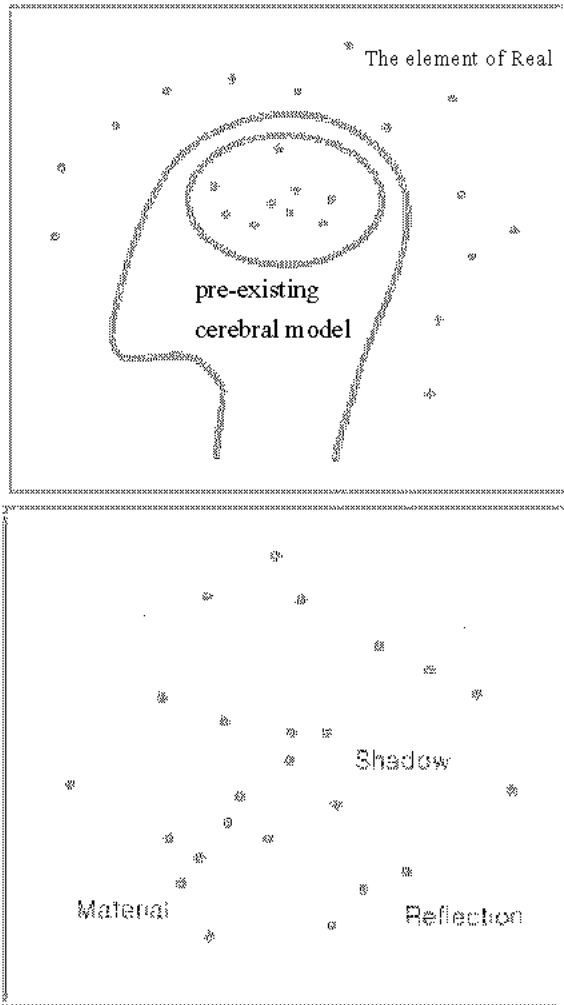
There are thin *kansei*, which are also called low sensitivity responses, and thick *kansei*, which are also called high sensitivity responses.

Thin *kansei* is the sensitivity on the basic sensual level, and uses words such as “heavy”, “light”, “bright”, etc., while thick *kansei* is the sensitivity on

a more acknowledging and abstract level, using words such as “beautiful”, “pleasant”, “elegant”, etc.

This kind of *kansei* is formed in a structure of several strata from low to high sensitivity response. Kato (reference 2) divided this *kansei* into 4 strata, namely “the physical chemistry level”, “the physiological level”, “the psychological level”, and “the acknowledgement level”.

This paper has the hypothesis that humans have a model in the cerebrum to recognize the outside world based on their sensitivity to their own previous experience and learning, and they will judge using this model when there is a sensory stimulation from outside (picture 1). Based on this hypothesis, it can be concluded that reality is judged by the process that comes from having a



Picture 1: pre-existing cerebral model

sensory response to an element. This response is felt intuitively when an individual sees something and judges it. He or she then concludes that the element looks more realistic than his or her pre-existing cerebral model (picture 1).

In this research, we explore 5 elements of those elements that humans sense. We look at the attributes of objects when they are displayed in cyber-space as 3 dimensional expressions. The attributes were chosen as a result of earlier experiments. The 5 elements include light, shadow, reflection, materiality and texture. Each element has its own area as shown in picture 1. The responses to stimulations in categories of the same element are mapped sequentially in the cerebrum. If a stimulation falls into the range of previous experience in any element, there is a positive response, otherwise the stimulation will be construed as not real.

1.2 Background of Research

The word “cyber-space” was coined through the development of communication technology and computers. It has become possible to experience non-existent space in practice by the new kind of medium. This cyber-space technology is used in many fields for simulation, education, training, visualization and communication. This is especially true for the realistic 3 dimensional expressions that are necessary in the simulation field of study.

However, it is possible that a big difference will occur in reality, even though the same tool is used for 3 dimensional expressions.

It means that a controllable model or function is not provided as a direct parameter in current 3 dimensional graphics tools.

1.3 Purpose of Research

This research aims to clarify the *kansei* stimulation elements sensed by humans who use 3 dimensional expressions in cyber-space, and to suggest the methods to express a more realistic cyber-space effectively.

2. Method of Research

2.1 Select Samples

25 samples (picture 2) were made by CG for this research (reference 3). The samples were analyzed by



Picture 2 : 25 samples

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
A	1	2	4	5	4	3	3	5	2	3	5	2	5	4	5	5	2	5	3	3	3	3	4	3	
B		1	5	4	2	2	5	2	2	5	2	4	2	5	4	5	5	2	2	2	2	2	4	5	
C			1	5	2	3	2	5	2	2	5	2	4	2	5	4	5	5	2	2	2	2	4	5	
D				1	1	4	3	5	1	4	3	4	2	3	4	4	2	4	4	4	4	4	4	3	4
E					1	4	4	1	1	4	3	4	4	2	3	4	2	2	4	4	4	4	4	4	2
F						1	3	1	5	2	2	5	1	4	3	5	5	4	5	5	2	1	1	3	5
G							1	2	5	5	3	4	3	4	4	4	4	4	4	4	3	3	3	3	3
H								1	5	1	2	4	1	4	3	5	5	4	5	5	2	1	2	3	3
I									1	5	3	3	5	4	4	2	4	4	2	2	5	5	2	3	4
J										1	4	2	5	3	3	4	4	5	5	2	2	3	3	3	3
K											1	4	2	4	5	5	4	5	5	3	2	2	3	3	5
L												1	4	3	4	5	1	4	5	5	5	5	5	1	4
M													1	4	5	5	4	5	5	5	2	2	3	3	5
N														1	4	4	4	4	4	4	4	4	4	4	4
O															1	4	4	4	4	4	4	4	4	4	4
P																1	4	4	4	4	4	4	4	4	4
Q																	1	4	4	4	4	4	4	4	4
R																		1	4	4	4	4	4	4	4
S																			1	4	4	4	4	4	4
T																				1	4	4	4	4	4
U																					1	4	4	4	4
V																						1	4	4	4
W																							1	4	4
X																								1	4
Y																									1

Table 1 : MDA-OR analysis data

Minimum Dimension Analysis of Ordered Class Belonging (MDA-OR), which is generally used as one of the multiple dimensional measurement constitutional methods.

This analytic method evaluates samples by 5 degrees of similarity (table 1), and clarifies the relationship of the similarities. The samples used in this research could be divided into 3 groups: the natural group, the character group and the product group, based on similarity (picture 3).

2.2 Experiment

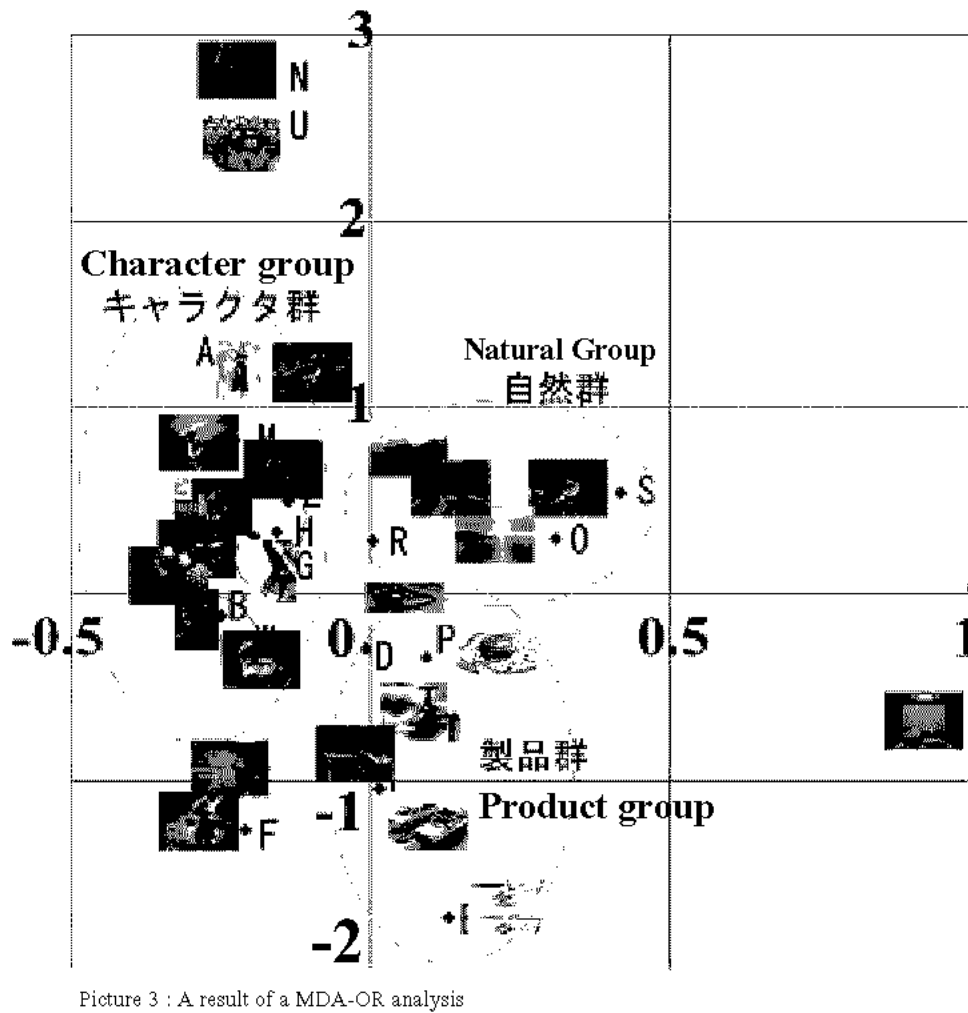
The examinees consisted of 9 faculty members and 3 students of Future University - Hakodate.

25 samples were shown to 12 examinees in three different tests as described below.

Examination1: Examinees were asked to mark samples into five levels of strength on the basis of how realistic the samples looked.

Examination2: Examinees were asked to rank the effectiveness of the 5 elements on the reality of the sample.

Examination 3: Examinees were asked to mark those samples that they sensed as realistic.



Picture 3 : A result of a MDA-OR analysis

評価者	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
栗原 雅亮	2	2	3	4	5	4	4	3	4	1	2	3	1	4	1	4	2	4	5	4	3	4	2	2	2
大塚 英一	2	2	3	4	5	2	5	4	5	2	3	5	2	3	1	4	4	5	5	4	4	2	1	2	2
高橋 英一	2	2	4	5	5	4	5	4	5	3	4	4	4	4	3	5	4	5	4	4	4	2	4	4	4
上野 敏雄	2	2	3	4	4	2	2	2	3	2	3	4	2	4	2	2	3	2	3	4	3	4	2	1	2
西野 由流子	3	2	4	2	3	2	4	3	3	2	3	5	2	3	2	3	4	2	2	3	2	1	2	1	2
日本 誠	2	1	3	4	4	2	3	4	2	1	3	4	2	3	2	2	4	3	5	4	2	2	3	2	1
原 善人	2	1	4	4	4	2	5	5	4	4	5	4	5	5	3	3	2	5	4	4	2	3	5	3	2
藤里 成輔	2	3	5	5	4	3	5	4	5	2	3	1	3	2	4	4	3	4	5	4	3	4	2	2	3
岡田 英博	4	1	5	5	1	1	5	1	4	1	4	4	2	5	4	1	2	5	4	1	4	4	1	5	1
坪 康子	3	2	4	5	4	1	4	3	3	3	1	3	2	1	1	2	5	1	2	4	1	2	1	1	1
形原 寿平	3	2	2	4	4	4	4	3	3	2	3	4	2	3	2	4	4	5	4	5	3	2	2	1	3
前橋 康平	3	3	3	4	4	4	2	4	2	3	4	3	3	3	1	4	4	4	4	3	3	2	3	3	3
	31	23	33	31	38	25	37	29	39	29	33	42	44	32	33	26	27	28							
	6	-14	6	12	10	-6	13	1	8	-12	0	3	-8	2	-3	-4	5	7	11	-4	-4	-4	-11	-10	-11

Table 2 The total data of the examination 1

3. Analysis

3.1 Examination 1: The examinees evaluated the 25 samples as realistic or not within 5 levels and totaled the points (table 2). Picture 4 is the bar graph of the total points divided by 25 of table 2 and made the average points 36.72 as 0

Samples D, E, G, I, L, and S were regarded as realistic, while samples B, J, M, O, W, X and Y were not. The results show that the samples which looked realistic belonged to the natural group and the product group, while samples which did not look realistic belonged to the character group.

It can be concluded from this that individuals' criteria of judgment of realism is based on whether or not the object exists in the real world.

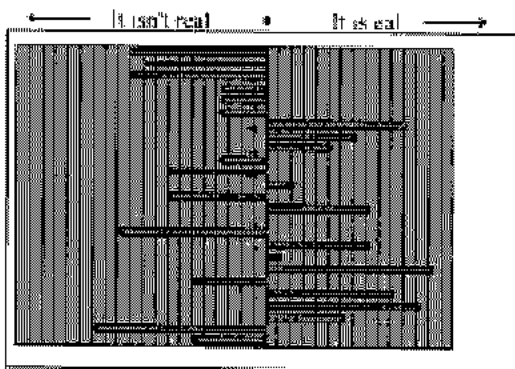


Figure 4 The graph data of the MDA-OR analysis

When people see CG works, they judge whether it is realistic or not using criteria and judgment of previous learning or experience, in the case that the object exists in reality (picture 5-B). However, it is difficult to judge

the degree of realism when people see something that does not actually exist in the real world, because there is no criterion to judge (picture 5-A).

C, in picture 5, corresponds to sample R and N. They looked realistic, even though, R and N do not actually exist. For this reason, the area made by the real world and the area which exists in cyber-space overlap each other. This makes people judge things as real, as if they have previously experienced it, without actually having done so.

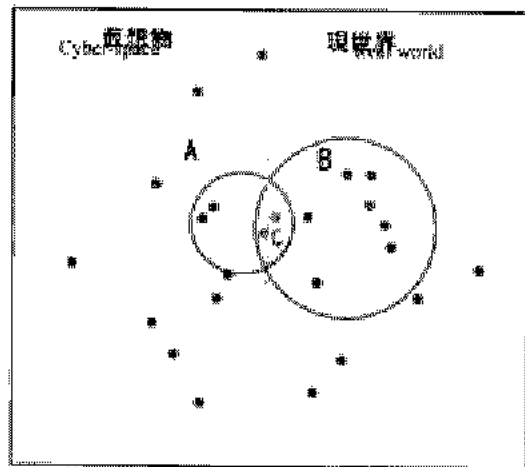


Figure 5 The standard which Real is judged

3.2 Examination 2: The examinees selected the element they judged which most contributed to the sample being realistic. They could choose from the 5 elements of light, shadow, reflection, material and texture to correspond with each of the 25 samples. Principal ingredient analysis method, the method to "dis-

主成分分析 The chief ingredient analysis

	第1番目	第2番目	第3番目	第4番目
固有値	10.0525018	6.90142726	4.75822177	3.26780919
寄与率(%)	40.2101271	27.005749	19.0828671	13.1512363
累積寄与率(%)	40.2101271	67.2158762	86.3487632	100

固有ベクトル

	第1番目	第2番目	第3番目	第4番目
A	0.19374039	-0.0139709	0.34503732	0.15952014
B	0.13986544	0.29289011	-0.0911093	-0.2285062
C	0.25081862	0.14617058	-0.0582721	0.2483423
D	0.22808178	-0.1930942	0.1888151	-0.0681328
E	0.17491145	0.03470261	0.23273139	0.38913586
F	0.30078437	0.00454589	-0.0103533	-0.0885464
G	0.20739892	-0.2114644	0.12478093	-0.2247843
H	-0.0049079	-0.2382846	-0.2916983	0.25170233
I	0.26447561	0.18790897	-0.1895019	0.07392363
J	-0.23020883	0.01220883	-0.157508	0.35291868
K	-0.0477007	-0.1784954	-0.1589013	0.4429742
L	-0.2552941	0.03513435	0.04502895	0.31520528
M	0.12888557	0.02603788	0.33849632	0.29349612
N	0.26372193	-0.0211387	-0.2444746	0.0637879
O	0.25700507	0.13515615	-0.1934126	0.09857309
P	0.29036419	-0.0577891	-0.1524075	0.0096643
Q	-0.1088038	0.15288723	-0.3885308	-0.0234057
R	0.20659217	-0.2495072	-0.1789101	0.02844843
S	0.20018631	0.15635572	0.27285863	0.15287381
T	0.18996897	0.24487577	-0.2284802	-0.1262117
U	-0.089307	0.36303584	-0.0459871	0.10087944
V	0.12524634	-0.3210129	-0.1480131	-0.0038663
W	0.27482797	-0.0693454	-0.1705601	0.13197874
X	0.06551523	-0.3435048	0.02856876	-0.1733103
Y	0.10653822	0.35103543	0.07989712	-0.0393264

The chief ingredient score

主成分成分	第1主成分	第2主成分	第3主成分	第4主成分
Light	-4.3556733	-0.2397683	-1.437908	1.89149163
Shadow	-0.2225078	0.29671299	0.83643236	0.5312567
Reflection	0.47257895	4.108303204	-0.3112534	-1.4178469
Material	4.55653896	-0.2498236	-1.1278314	1.55620744
Texture	-0.450937	-3.1701427	-0.3520352	-2.3614069




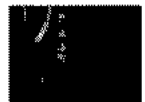




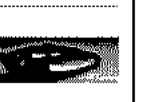






table3 : For the chief ingredient analysis, result

cover the structure”, was used after compiling the data (picture 3).

Mathematically speaking, it is the “summarizing description of development” method, that is to say, the method to search for the principal of development by compression of abandoned data (reference 3).

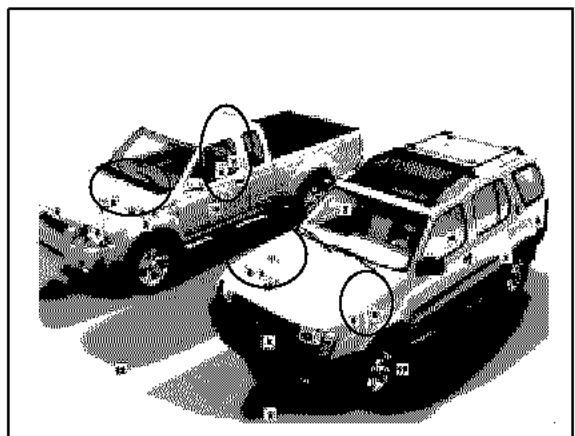
The results of the analysis conclude: The first principal ingredient is the material (as sample P, N, O, I, C), the second principal ingredient is the reflection (as sample U, Y, T, I, S) and the third principal ingredient is the shadow (as sample A, M, S, E, D) from the aspect of the principal ingredient points (picture 6).

It can be conjectured that people are affected in order of material, reflection and shadow, when they sense reality in seeing 3 dimensional expressions of CG.

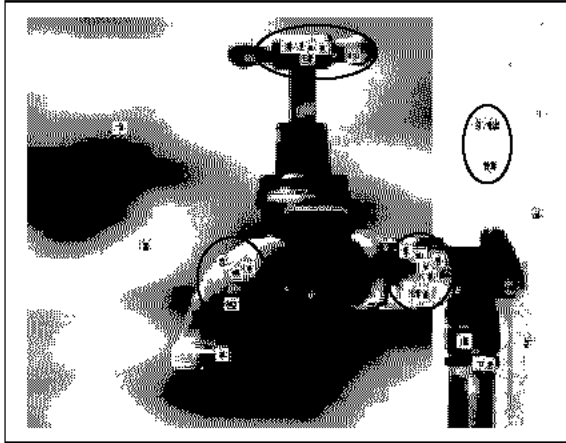
The first principal ingredient is the material	The second principal ingredient is the reflection	The third principal ingredient is the shadow
 P 0.2908	 U 0.3630	 A 0.3420
 N 0.2637	 Y 0.3510	 M 0.3384
 O 0.2570	 T 0.2446	 S 0.2726
 I 0.2544	 I 0.1875	 E 0.2337
 C 0.2508	 S 0.1553	 D 0.1988

Picture 6 : The sample of the relations which is resistant to each chief ingredient

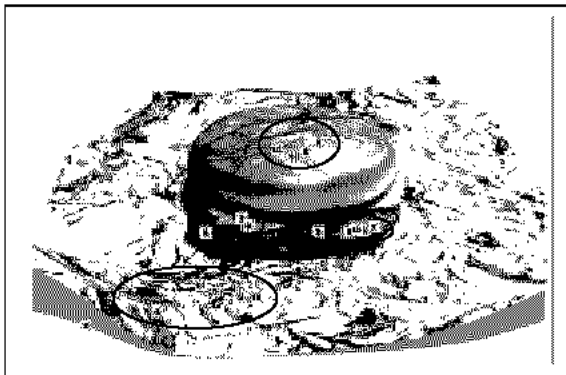
3.3 Examination3: Examines marked those samples they sensed as realistic (picture 7, 8 and 9). This examination aimed to clarify which point the examinees focused on when they observed the samples. When com-



Picture 6 : The result "sample I" of the examination 3



Picture 7 : The result "sample D" of the examination 3



Picture 7 : The result "sample P" of the examination 3

pared, the marked samples in this experiment and the data from the principal ingredient analysis method were identical. It seems necessary to have a more accurate investigation into this.

4. Conclusion

This research aims to clarify what kind of elements make humans sense realistic objects when they view works of 3 dimensional expressions in cyber-space. The result of this research shows that individuals are affected by material, reflection and shadow elements when they sense reality in viewing 3 dimensional expressions of CG. However, there is not enough time to discuss more fully the certainty of the elemental factors in perceiving object realistic. Further research will focus on clarifying, numerically, the range of the elements' effect on human perception of realistic. There is a stronger possibility to produce new algorithms with more realistic expression for 3 dimensional expressions in cyber-space.

5. Reference

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