Environmental Effect on Emotion in Waiting Areas Based on Kansei Engineering and Affective Neuroscience

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Abstract: In general, for health care centers it is vital to know the kind and the intensity of emotions felt by its patients and how to influence their quality of life and their response to therapies. In particular, waiting areas in which patients spend a lot of time without significant interactions is an important focus of this study. Recent studies suggest that a quality in fact and in perception is two significant parts, which affect and play a powerful role in an overall satisfaction in health care. The aim of this study is to understand how to increase positive and decrease negative emotions by a re-design of waiting areas inside health care centers where patients spend a considerable amount of time without any significant interactions. To measure the quality of satisfaction felt by patients inside of such an environment we refer to their emotions that we model basing on Affective Neuroscience. According to Panksepp, we have a categorized and unambiguous number of emotions, precisely defined from a neuroscientific and physiologic point of view: SEEKING, PLAY, CARE, FEAR, GRIEF, RAGE and LUST. We collect Kansei words and structure them with these emotions. We perform 600 surveys on 200 patients in 4 different waiting areas found in 2 hospitals to reveal differences in perceptions. We conduct experiments and our results lead us to several considerations about how to design desirable emotional characteristics of a waiting area.

Keywords: Waiting Areas, Health Care, User Experience, Primary-Process Emotions, Kansei Engineering.

1. INTRODUCTION

Among numerous features, quality of healthcare is affected by several factors such as context and condition of environment and behavior of personal factors and patient (Irurita, 1998). More recently, a growing body of evidence is suggesting that the environmental design of healthcare centers influences the quality of care. As suggested by Omachonu (Omachonu, 1990), the quality of care involves an increase in desirable and reduction in undesirable patients' outcomes. However, quality of care is an ambiguous term, which can refer to its two constituents: quality in fact and quality in perception. Patients' perception plays a critical role in their satisfaction with healthcare (Devlin and Arneill 2003; Omachonu, 1990). Arnel and Devil also argued that the quality of care perceived by patients is considerably associated with the amount of empathy, warmth, and friendliness that the patient experiences. Namely, Winkel states that an environment does convey empathy and warmth even before the patient interacts with the staff. The environment's overcrowding, noise, lack of privacy, implied communication between patients and healthcare providers, strange equipment in assisting in treatments may influence the persons' feelings (Winkel, 1986).

These stress factors can have a negative impact on the process of healing the patient. Ulrich has defined the consequences of such stress, psychologically, physiologically and behaviorally, and found that a key underlying mechanism generating these consequences phenomena appears to be the "diversion of one's attention from the immediate ailment to environmental stimuli that is pleasant to the senses" (Ulrich, 1992). He also found further supportive qualitative evidence in literature review that a design of environment (the usage of daylight, nature distraction, appropriate lighting, better ergonomic design, rooms, floor layouts, work settings) does influence a patient's experience in health care (Ulrich, 2008).

A waiting area is thus referred to as a "servicescape" where a part of service is delivered, perceived and where the staff and patient interact (Bitner, 1992). Reimer also confirms that this interaction within servicescape influences users' evaluation and has a direct and indirect effect on perceived service quality (Reimer, 2005). Thus, by mapping the psychological experience of persons' waiting in waiting area we can understand better the perception of the users. (Katz, Larson and Larson, 1991). Latest research has also proposed a framework for creating the environment change that can be related to the improvement of health (Berke and Moudon, 2014). In numerous services, waiting has become a pivotal factor in satisfaction and quality judgment (Dube, Schmitt and Leclerc, 1991; Taylor, 1994; Taylor and Claxton, 1994). Many providers attempt to reduce the negative effects of waiting by solely cutting the length of the wait through modifying the service delivery system (Sasser, 1976; Shostack 1987). Indeed, an improvement in the interaction experience of physical design attributes could help to create customer value for physical aspect of Kansei (Nagasawa, 2006). These studies clearly demonstrate the influence of the environment on human perception and suggest a hypothesis that a redesign of waiting area environment can have an impact on human emotions.

Our study aims at determining the environmental characteristics critical to design emotionally satisfactory waiting areas. We ameliorate existing study in Kansei Engineering by expanding the same technique focusing on the design of an interior. Second, these results help us to know more about psychological responses to the physical setting of healthcare environment. Finally, the usage of Panksepp's basic emotion as a main model in our research helps us to have a comparable and

unambiguous definition of emotion in our research.

CAN WAITING AREAS DEPICT EMOTIONS?

There is a growing interest in understanding patients' needs in health care services (Arnel and Devil, 2003; Leather et al. 2003). Respectively, patients' needs should be correlated with their feelings. Overall research in Affective Computing uses measures of the emotional responses of individuals which has been experimental-based and generally relied on analyzing the participants' facial (McDuff, el Kaliouby and Picard, 2012), vocal (Dellaert, 1996) and bodily expressions (Kleinsmith, Bianchi-Berthouze, 2013; Radeta and Maiocchi, 2013) in addition to their verbal descriptions of their feelings. In this study we focus solely on verbal interpretations of the perception in waiting areas (in further WA).

As our aim is to assign emotions to physical properties of the space we opted for emotional model from general research in Affective Neuroscience which describes 7 primary-process emotions: SEEKING (expectancy), FEAR, RAGE, LUST, CARE, GRIEF (sadness) and PLAY (social joy). Names of emotions are written with capital letters according to authors' notice as they represent the exact brain areas and neurotransmitters. These emotions are similar for all mammals (Panksepp, 1998) and we can understand them as being both positive (desirable) and negative (not desirable) for each person. When referring to the WAs, we will use this taxonomy of emotions as our model for structuring our collected Kansei words which we will explain in further.

Briefly, Kansei is a Japanese word which depicts senses, human preferences, feelings etc. Kansei Engineering is a technology and methodology on design or development level, which translates "Kansei", (that is, senses, human preferences, feeling, images etc.) of a person into a concrete product (Takagi, 2004). The data in Kansei engineering is obtained from a collection of adjectives (which are treated as kansei words) that help to construct the semantic space for the design of a product. As an overall goal of Kansei is translating human emotions into appropriate product physical design elements, which contain size, shape, color and texture, in the remainder of this paper we try to group and assign these words to human feelings per each of the waiting areas. We use Kansei words combined with the defined taxonomy of the emotions for the purpose of understanding the perception and emotions felt by persons in WAs.

2. METHODOLOGY

For this study, Kansei Engineering (KE) type "I" was used. We opted for KE model proposed by Schütte, which was feasible in our facilities. This model is a 6-step process and was used in our previous study to link product emotions with product properties (Shafieyoun, Koleini Mamaghani and Jahanbakhsh, 2010). In this paper we apply the same model, however, we use it for the physical environment and in particular, the waiting area. We follow Shütte who anticipated that the "future growth of Kansei Engineering and the application of new areas make it necessary to allow the integration of more tools and methods from other areas" (Schütte, 2004).

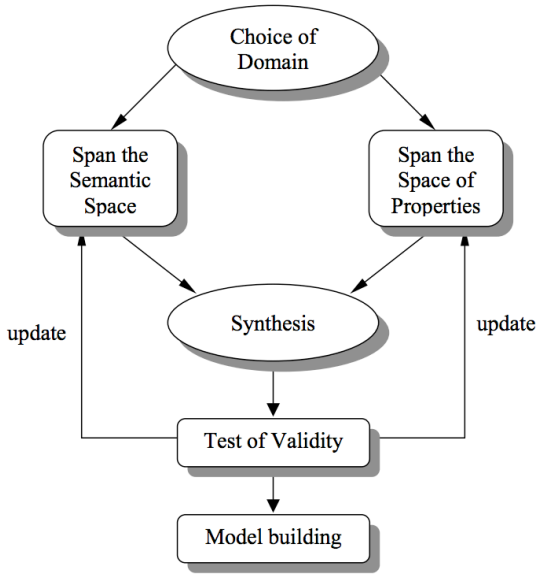

Figure 1: KE model proposed by Schütte (2005).

2.1. Choice of the Domain

Our study subjects were 200 patients who are diagnosed with cancer. Fifty patients for each four WAs were distinguished in two hospitals (Istituto Nazionale dei Tumori and Besta in Milan, Italy).

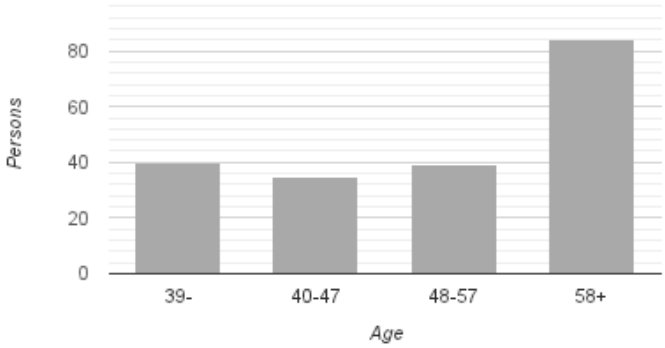

Figure 2: Age distribution among subjects

2.2. Spanning the Semantic Space

In our study, we use Kansei words (KWs) to describe the environment of the WAs by obtaining 650 adjectives (KW). We collect them from magazines, Internet, books, papers, and dictionaries, as well as from personal observations where adjectives have been collected by spending one week during both day and night inside the hospital. In the next step, we used manual expert method by the designer's choice to perform the word structuring (Table 1). We grouped 325 of them and finally to 24 which we classified into 6 out of 7 primary-process emotions. Some of these KWs are presented in Tables 1 and 2 below. We excluded LUST as it did not apply to the hospital environment. For each of the emotion we obtained in average 4 Kansei Words, which we believe are the nearest representatives to the emotion definition in Affective Neuroscience (Panksepp, 1998).

Table 1: Manual Expert Method of structuring the Kansei Words (from left to right)

650 KW (vocabulary)	650 KW (grouped by synonyms)	325 KW (filtering by similarity)	24 KW (representative Factor Word)	Assigned Emotion per KW
Stressful	Stressful	Stressful	Stressful	RAGE
	Troublesome			
Scared	Nervous	Anxious		
	Anxious			
Shocked	Scared	Agitated		
	Agitated			
Anxious		...		
	...			
Troublesome				
Crowded				
Agitated				
Frozen				
Nervous				
...				

Table 2: Final 24 Kansei Words structured per 6 emotions from Affective Neuroscience

SEEKING	CARE	PLAY	FEAR	GRIEF	RAGE
Calm	Nice	Moving	Hateful	Depressed	Agitated
Slow	Funny	Alive	Confusing	Boring	Heavy
Quiet	Beautiful	Active	Exciting	Sleepy	Chaotic
Apathetic	Friendly	Dynamic		Dozy	Lazy
	Tranquil				

2.3. Spanning the Space of Properties

We choose four WAs, which had easier access for performing our study. It is worth mentioning also that patients in these areas are suffering from cancer. These areas had diverse characters (as depicted in the Table 3 and in Figures 3 to 6) for the purpose of revealing similarities and differences in patients' perception. Each WA had the capacity of 50 persons waiting to be accepted for medical check.

Table 3: Characteristics of the Waiting Area (WA)

W A	Regional Characteristic	Social Characteristics	Design Characteristics
1	Radiology (INT)	Patient and Family	small, warm color, painting, sculpture, TV, alarm, timetable, private, small, magazines and books, compliment book.
2	Small for test (INT)	Reception, Patient, family and staff	metal desk, cold colorful, public, big windows, flower vase, table and chair at reception, doors
3	Main (INT)	Patient, family, staff	big, metal desk, cold color, timetable, alarm, skylight, windows, painting, public, flower vase, doors
4	Small for test (Besta)	Patient, family, staff	metal chair, gray, painting, public, timetable, alarm, magazine, door

Figure 3: Waiting Area 1

Figure 4: Waiting Area 2

Figure 5: Waiting Area 3

Figure 6: Waiting Area 4

2.4. Synthesis

We ascribed KW's to WA's by using the Manual Expert Method, as it is the oldest and being accepted as having more accessible tools (Shütte, 2005). Our study participated 200 patients and we performed a total of 600 surveys in 4 WA's. The distribution of patients was equal for each of the WA's, having 50 patients per room. Each patient had 3 types of the surveys and a task to match 24 KW (short listed above in Table 2). The same KW was used for each of the 3 surveys: color, furniture layout and materials. Survey was based on semantic differential method with 7-point empty spaces ranging 1-3 (not so good), 4 neutral and 4-7 (very good).

Figure 7: An example of 7-Point Scale used throughout the survey

After collecting the participants' answers, in next step we asked 10 designers to perform the same structure of 3 surveys (additional 30 surveys), however by imagining an ideal WA.

3. RESULTS

Below are survey results of all 4 WAs and Ideal WA. We observe that in Ideal WA “Beautiful”, “Friendly”, “Nice”, “Active”, “Alive” and “Dynamic” Kansei Words have higher rates.

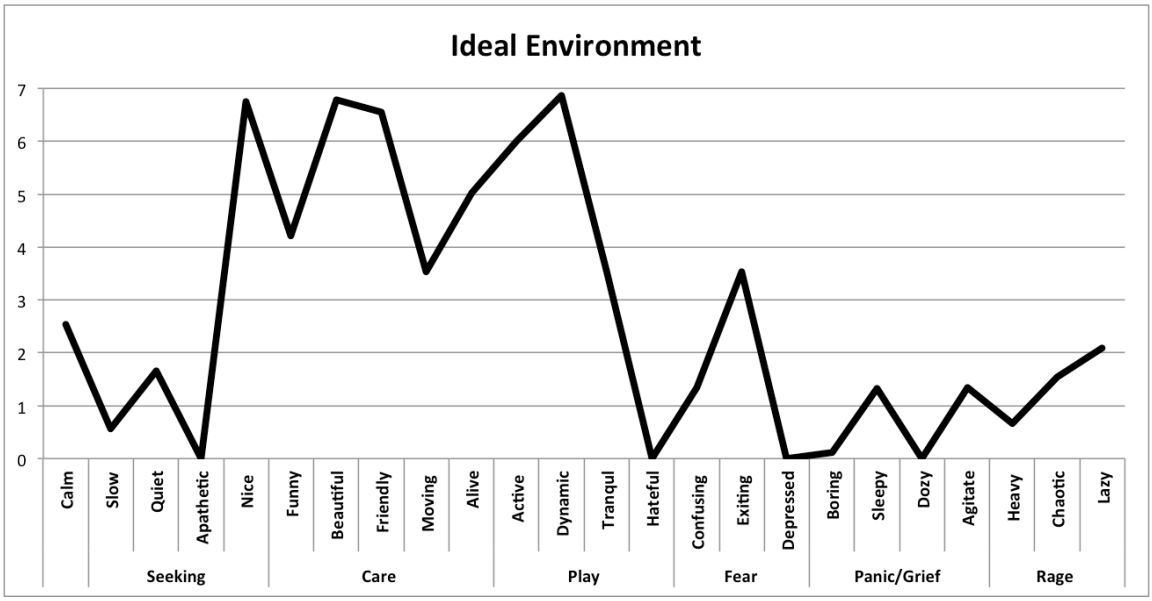

Figure 8: An Ideal Waiting Area seen by designers

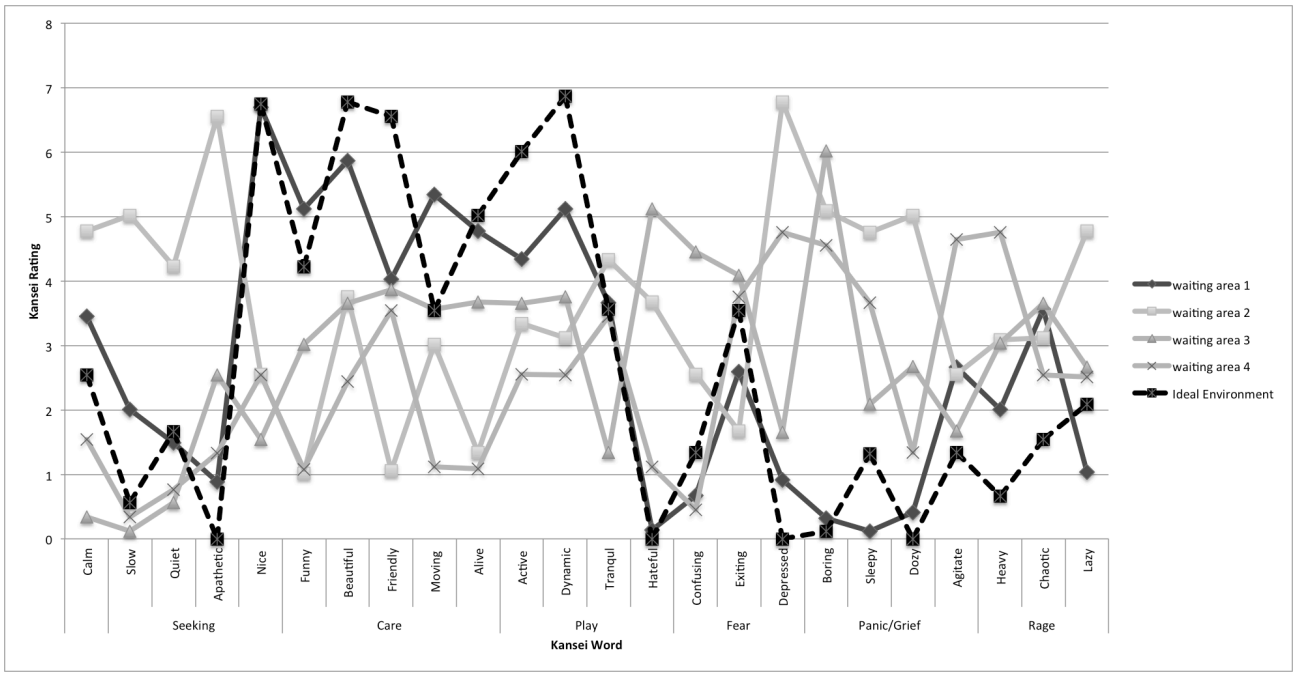

Figure 9: All Waiting Areas seen by participants

The data was treated with factor analysis with the purpose of semantic structuring. This was done in SPSS (Statistical Package for Social Sciences), which is commercial statistical software. The input data were the mean values for the 24 KW’s describing each of the 4 WA’s and including an ideal WA. We used this method as the factor analysis to simplify this raw data and to reveal connections between each of the WA’s. Results below demonstrate new categories of KW by

performed factorial analysis. All KWs were reduced to five factor-words: Gloomy, Friendly, Active, Confusing and Agitated, which had the highest loading in more than one analysis. Factor 1 (Gloomy) for color are: “Tranquil”, “Calm”, “Quiet”, “Boring”, “Sleepy”, “Dozy” and “Depressed”. We can observe that there are no adjectives +4 in Ideal WA. Factor 2 (Friendly): “Nice”, “Funny”, “Beautiful” and “Friendly” are +4 in ideal WA. According to the amount of Kansei Rating in 4 WAs we can observe that WA 1 have +4 rating in these adjectives. Factor 3 (Active) “Alive”, “Active” and “Dynamic” we observe +4 in Ideal WA and WA 1 having all of this adjectives +4. Factors 4 and 5 respect the similar trend. Finally, we find out that the color of WA 1 has been perceived friendlier and have more positive emotion for users. Results below demonstrate a comparison of an average participants’ of 1-7 ranged values among all 3 attributes: color, furniture layout and material.

Table 4: Kansei words per Color
(* Adjectives 4+ are rating for Ideal Waiting Area)

Factor 1: Gloomy	**Factor 2: Friendly**	**Factor 3: Active**	**Factor 4: Confusing**	**Factor 5: Agitated**
Tranquil Calm Quiet Boring Sleepy Dozy Depressed	* Nice * Funny * Beautiful * Friendly Slow Apathetic	Moving * Alive * Active * Dynamic	Confusing Exciting	Agitated Heavy Chaotic Hateful Lazy
-	**= WA 1**	**= WA 1**	-	-

Conversely, Factor 1 in Table 5 is “Slow” and includes “Hateful”, “Tranquil”, “Quiet”, “Slow” and “Apathetic” which has no +4 adjectives however having instead 3 adjectives (“Hateful” and “Apathetic” and “Slow”), which are less than 1 in Ideal WA. We can also observe that the WA’s 2 and 3 have +4 rating of Kansei in these adjectives. In addition, in Table 7 we observe the results of negative emotions in WA’s. Table below shows WA’s 1 and 3 as favorite selection for furniture layout.

Table 5: Kansei words per Furniture Layout
(* Adjectives 4+ are rating for Ideal Waiting Area)

Factor 1: Slow	**Factor 2: Nice**	**Factor 3: Active**	**Factor 4: Dynamic**	**Factor 5: Chaotic**
Hateful Tranquil Quiet Slow Apathetic	* Nice * Beautiful * Friendly Sleepy Dozy Lazy	Moving * Alive * Active	* Dynamic Confusing Exciting	Agitated Heavy Chaotic Calm Depressed * Funny Boring
-	**= WA 1, 3**	**= WA 1, 3**	**= WA 3**	**= WA 3**

Under the word "Material" we consider any material in environment, which can be tangible material in furniture or a wall texture. We can see in table below that users chose WA1 as the best WA in case of material.

Table 6: Kansei words per Material
(* Adjectives 4+ are rating for Ideal Waiting Area)

Factor 1: Sleepy	**Factor 2: Calm**	**Factor 3: Active**	**Factor 4: Confusing**	**Factor 5: Agitated**
Slow Apathetic Boring Sleepy	* Beautiful * Friendly Depressed Tranquil Calm Quiet	Alive * Active Dynamic * Nice Funny	Hateful Confusing Exciting Moving	Agitated Heavy Chaotic Dozy Lazy
-	= **Waiting Area 1**	= **Waiting Area 1**	-	-

We believe that decreasing negative emotion and increasing positive ones in new WA's would be possible by knowing better the perception of people. Though, we can depict negative elements of each WA by choosing adjective less than 1 in Ideal WA and +4 in our WAs. The result is shown in the table below.

We merged SEEKING with GRIEF; SEEKING is a mother emotion (Panksepp, 1998), which serves as a channel to enhance other ones. Results below depict comparison of Kansei Words of four WAs with negative and positive adjectives for three characteristics: color, furniture layout and material. In overall, WA1 has more positive emotions for all three factors. WA3 has a friendly Furniture Layout but other factors dominate negative emotions. By analyzing the character of WAs we obtained a better insight in perception of participants.

Table 7: Kansei words with 7 Panksepp's Emotions per WAs

	Positive		**Negetive**		
Emotion	**CARE**	**PLAY**	**FEAR**	**SEEKING/ GRIEF**	**RAGE**
COLOR					
KW	Friendly	Active	Gloomy	Confusing	Agitated
WA	= **WA**1	= **WA**1	= **WA**3	= **WA** 2,3	= **WA**4
FURNITURE LAYOUT					
KW	Nice Funny	Active Dynamic	Hateful	Slow	Heavy
WA	= **WA**1,3	= **WA**1,3	= **WA**3	= **WA**2	= **WA**4
MATERIAL					
KW	Calm	Active	Agitated	Apathetic	Boring
WA	= **WA**1	= **WA**1	= **WA**3	= **WA**2,3	= **WA**2,3

4. DISCUSSION

This study applied Kansei Engineering (KE) type I to design a waiting area (WA) for two hospitals in Milan, Italy. The majority of participants used in our study are being diagnosed with cancer. The results of this study were qualified by using factor analysis of user's perception of the WA. KE type I was used because it was compatible with available resources. Our study shows that the WA1 is the best sample of Positive emotion according to color, furniture layout and materials, whereas WAs 2 and 3 have more negative emotions. It is also notable that a WA1 resembles a private room with a warm color (decorations, paintings and sculptures) where the texture of furniture is warm and friendly. Patients prefer warm colors instead of bright colors (Devlin, Arneil 2003). Based on our on-field observation, people generally sit next to each other and enjoy by sharing their feelings during the waiting time in WA1. We also observed that people in WA1 had a more expressed feeling of respect. Our study suggests that using artworks in WA can stimulate PLAY. Textures and warm colors can provide satisfaction by provoking CARE. It is also obvious that a furniture layout can enhance more SEEKING in this WA. According to our findings, Was 2 and 3 included negative signals among the participants that could be attributed to cold colors and the usage of metal for furniture as well as by the dispersion of furniture. This implies that these two remaining WAs together with other characteristics reported in literature are being in general more negative. Therefore, by understanding increased positive feedbacks in WA1 against findings in literature review we have a potential candidate for PLAY/CARE WA. Comparing an ideal environment with the results of our research study underpins how it is possible to decrease negative and increase positive emotions in a WA. Our future step is to perform a validity test as well as to propose a concrete design model.

After completing comparison with other cases which used KE method, we figured out negative elements of WAs besides positive ones which can be used to decrease the impact of negative emotions and increase positive ones in designing the new environment.

A recent study conducted by Ebru Ayas, Jorgen Eklund and Shigekazu Ishihara (Ayas, 2008) used KE method to design WA. They applied CA (Correspondence Analysis) and X2 independency tests analyses in SPSS and Rough Set (RS) method to extract decision rules between Kansei in ROSE software. They used interviews in their survey with closed questions. Obviously, this method is not a usual method for designing the environment but it seems possible to propose a new approach in KE type I in Design Environment.

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Biography

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Marco Maiocchi, physicist, Assistant professor in Computer Science since 1973, presently full professor at Politecnico di Milano, Design Dept. After 20 years of research in Software Engineering, he moved in the last 15 years, toward Communication and Emotional Design. In 1978 he founded Etnoteam, system integrator; till 2004 he has been the CEO of I.NET, company of the British Telecom group. Responsible for many national and international research projects, he is the author of many books and hundreds of scientific papers.