

Case study about a new design concept for public outdoors playgrounds through understanding children's *Kansei* related to play equipments in Chiba city

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Abstract: Providing children a proper play area is necessary since play is considered as one of the fundamental importance for their developments and learning. Today's children may have different expectation about forms and functions of play equipments comparing with the last generation that should be studied. As a case study the samples of 70 outdoors play area in Chiba city, Japan have been categorized based on the play equipment and the kinds of activities provided to children. The subjects are elementary school children. The fieldwork of this study focuses on subject's expressing *Kansei* words about the samples as well as their activities at playgrounds. The derived data from the fieldwork are analyzed through the methods of Quantification Theory Type III and Cluster Analysis. The extracted results can lead us to the checklist and guidelines for the play area based on children's behavior and emotions.

Key word: *Design concept, Kansei analysis, Outdoor play equipment, Children.*

1. Background

Play of children has invaluable benefits for their developments. It provides children a sheer joyful and happy time. One of the essential types of children's play for children developments is playing in outdoors play area. There are three main reasons why outdoor play is critical for young children especially in early childhood and elementary schools remarkably in this era. The first reason is that any of the developmental tasks that children should acquire such as physical and social development, risk-taking and the engagement of many of basic knowledge can be most successfully learned through outdoor play. The second reason is that new culture and life style are taking outdoor play away from young children through excessive digital games, computer use and TV, have made children away from outdoor play. The third reason is parents' force on learning more academic subjects to children and the academic standards push more and more developmentally improper academics into our early childhood programs. Today, composite play structures are designed to contain a wealth of different activities and to meet exacting standards of safety and compliance. However, just a new play structure does not necessarily mean kids will find it exciting. So it is important to record a variety of points that can assist designers

in creating an environment that children will find irresistible and will enrich their “work” of play. There are many developmental design methods with the aim of recognizing and understanding user’s more needs and preference for products. In *Kansei* Engineering as one of the human-centered methods the aim is to develop products that users want to have deeply in their mind and give them satisfaction feeling when using the products. This method is able to grasp the users *Kansei* and analyze them and transfer analyzed data for promoting the new design and design concepts, In the beginning of the 1970s, the concept of *Kansei* Engineering was introduced in Japan. The *Kansei* engineering is able to grasp the consumers’ *Kansei*, to analyze the *Kansei* using statistical methods, and to transfer the analyzed data to the design domain [1].

Kansei engineering is an engineering tool. It collects the users’ emotional needs and establishes mathematic prediction models of how the emotional needs are connected to selected product properties [2].

2. Introduction

Childhood is a very critical period in the psychological development of the human’s life. Through the preschool and early school years, fundamental patterns of physical and motor skills, mental and cognitive skills, self-concept, emotional, and social behaviors are acquired. Having some problems in development in any of the psychological areas, effect on the child’s subsequent development. The growing body of researches and literatures discuss about play’s potential role in human development and evolution. As knowledge about the benefits of play has grown, the involvement of communities in providing play opportunities has increased. Playgrounds are a major source of play interaction, funded and supported by communities [3]. From 1920 many organizations have materialized article and researches about play and playgrounds. Those groups developed a list of equipment most beneficial for children of specific ages as a standard of playgrounds and recommended the equipments for children. We know that our society has changed drastically since the 1920s, however the basic structure of playgrounds has remained almost the same. Some of the standard play equipment may be considered necessary for developing some aspects of motor development, but it is important to provide modified versions of them in terms of children’s new needs and interest. It is crucial that a wider variety of equipments being placed on modern playgrounds. While industrial design and product design have been concerned with manufactured products, the emphasis has been on the objective and physical structures of the products as well as the forms, shapes, and the material. Even though these are all important but recently the focus has changed from objects to the experiences that caused by using them. We need to understand experience. We need to understand how psychology, the social sciences, communication, and business shape a person’s experience [4] In the human-centered design method the prior intention and the aim is to develop the products to the users wants and demands. Those methods such as *Kansei* engineering are able to understand the users emotional and analyze them for transferring the analyzed data to the design issue. During an investigation which was about outdoor play equipments and children’s development; I faced many children who play with play equipments in local parks in the way that are different from the intended design concept for the equipments. Considering these as a hypothesis that today’s children, as the main users of outdoor play equipments, have some special need and wants about forms and functions of these equipments; It is essential to recognize their expectation according to the playground. In this research as a case study the numbers of 70 public parks in Chiba city (Japan) have been observed and the existence equipment and facilities in those parks were recognized. In the second step an interview investigation was carried out with some elementary school children as the subjects of this research. The aim of the interview was to recognize the most well known equipments as the samples of this research. The

numbers of 27 samples were recognized. In the third step the observation investigation have done to find out about the kinds of play and behaviors of children with the samples. The forth step was another interview investigation, the subjects were asked to express *Kansei* words about the samples. The derived data from the fieldworks are analyzed through the methods of Quantification Theory Type III and Cluster Analysis. The results of this research would be useful to find the checklist and guidelines for the play area based on children's behavior and emotions. After all we can get a directions of new concept for design of outdoor play area, that provides children's emotional preference more and are correspondence with their actual behavior at playgrounds.

3. Steps and methods:

This research just likes most design researches, has been completed through two main steps. The first step is investigation such as observation and interview, the second step is analyzing the gathered data from investigations.

4. Investigations:

4.1 Investigation on local parks in Chiba city

Chiba is the capital city of Chiba Prefecture, Japan. It is located approximately 40 km east of the center of Tokyo. Chiba city has 6 wards and on each districts there are some local parks.

In this research 3 wards of Chiba city were investigated and almost 70 parks located in Chuo Ward, Inage Ward and Mihama Ward were observed. The data of the play facilities and the equipments in parks were recoded by taking photographs. The parks varieties are from a simple and small green area furnished with just one play equipment to a wide area furnished with huge compound play equipment set (Fig.2 & 3). There were different kinds of old and new play equipment manufactured from wood, metal, plastic, cement or a combination of two or more material together.



Figure.1 Map of Japan (Chiba)



Figure.2 Component Park



Figure.3 Simple Park

The observed play equipments can be categorized into the five main groups according to function and form such as slides, swing, climbers, tunnels and other play structures. In all of the observed park totally 51 types of play equipments and play area were recognized. All of them are listed and shown in the following table (Table 1). Since all of the recorded equipment were not available in most parks and were not well known to all children it was necessary to choose some samples for next steps.

Table 1. Recorded play equipments

<i>SLIDES</i>	<i>SWINGS</i>	<i>CLIMBERS</i>	<i>TUNNELS</i>	<i>OTHERS</i>	
1.Tube slide	12.Simple swing	17.Net climber	30.Net tunnel	35.Arch bridge	48.Jungle gym
2.Animal slide	13.Ball swing	18.Arc climber	31.Ring tunnel	36.Suspention bridge	49.Spring mat
3.Double slide	14.Belt swing	19.Spiral climber	32.Tire tunnel	37.Chain bridge	50.Standing spinner
4.Spiral slide	15.Tire swing	20.Chain climber	33.Tube tunnel	38.Hopping pods	51.Combination set
5.Straight slide	16.Stand swing	21.Ramp climber	34.Cement tunnel	39.Game panel	
6.Wide slide		22.Ramp with rope		40.Sand play area	
7.Roller slide		23.Scramble net		41.Net mesh	
8.Cement slide		24.Wall climber		42.Gym bar	
9.Fireman slide		25.Space net		43.Monkey bar	
10.Trolley slider		26.Cliff climber		44.Log roll	
11.wave slide		27.Over head ladder		45.Sea saw	
		28.Deep rung climber		46.Balance bar	
		29.Ring ladder		47.Play house	

4.2 Investigation of the most familiar equipments to the subject among observed equipments

After recognizing and recording all the play structures in 70 parks, the numbers of 51 play structures were identified. In this step, it was needed to choose some samples that are better known to children. So, an investigation has been conducted to find most familiar equipments to children. The subjects of this research were 11 elementary school children. The photos of all the recorded play structures have shown to the subjects. They were asked to choose the play equipment, which they have the experience of using them. Children have selected the numbers of 20 play equipments. The selected equipments are listed in the following table (table 1).

Table 2. The most familiar play equipments to children.

<i>SLIDES</i>	<i>SWINGS</i>	<i>CLIMBERS</i>	<i>TUNNELS</i>	<i>OTHERS</i>
1.Tube slide	6.Simple swing	9.Arc climber	13.Tube Tunnel	16.Balance bar
2.Spiral slide	7.Belt swing	10.Chain climber	14.Cement tunnel	17.Hopping pod
3.Roller slide	8.Tire swing	11.Jungle gym	15.Net tunnel	18.Net mesh
4.Cement slide		12.Ramp with rope		19.Spring matt
5.Fireman pole				20.Suspension bridge

4.3 Observation of the children’s behavior and play on the selected equipments

In previous step after the most familiar play equipment to the subjects were recognized as the samples for this research, for the next step in this part the behaviors of children with the samples have been observed. The observation had been conducted while children were playing or doing other activities at the parks. Taking

photograph and note writing have recorded the data of the observation. The results show that the local parks in Japan are used mostly during daytime and afternoon till 5 o'clock. The afternoon users are almost elementary school kids who go to parks usually soon after going back from school. This observation investigation has conducted in afternoon hours. The activities of children according to the play equipments can be categorized into two main lists, the foreseen and the unforeseen. The foreseen design activities are the activities and plays that were the main purpose of the design for that equipment. For example slid has been considered as a device for sliding from up to down. But the second group is the activity and behaviors that children doing in play area and on the play structures which are different from the design intention of the equipment. For example going up from down to top of the slide, while usually the slides are considered for sliding from up to down. Some of the children's activities can be seen in the series of photos shown in figure3. Also the physical and behavioral activities of children during observations are shown in the following tables.



Figure 3. Some of children's activities at the samples

Table 3. Children’s activities and play at the samples.

All the observed play and activities at the samples		The foreseen design activities	The unforeseen design activities
Pushing and puling	Lie down sliding	Balancing	Swinging with different body position
Swinging with different body position	Squatting Sliding	Climbing	Couple swinging
Couple swinging	Crawling from down to top	Crawling and knee walking	Going to upper place and roof
Going to upper place and roof	Sliding	Going up	Prostrating
Prostrating	Stand sliding	Hand over hand	Backward sliding
Backward sliding	Going up over the tube slide	Hanging by arms	Going upward on the slide
Going upward on the slide	Ball playing	Hopping and skipping	Playing games and card games
Group playing	Lying down & resting	Jumping	Competition
Playing games and card games	Climbing	Lifting	Jumping from upper part
Competition	Hopping and skipping	Pushing and pulling	Chatting
Parallel play (peer)	Jumping between two high parts	Sliding	Going to the reverse side of the bar
Jumping from upper part	Playing baseball	Swinging	Lie down sliding
Chatting	Tag playing (Onigokko)		Squatting Sliding
Going to the reverse side of the bar	Reading book		Crawling from down to top
Hanging			Stand sliding
Creeping			Going up over the tube slide
Balancing			Lying down & resting
Crawling and knee walking			Jumping between two high parts
Running			Tag playing(Onigokko)

4.4 Interview investigation on subjects’ impression about samples (play equipments) to derive *Kansei* keywords

The subjects for this investigation were 11 elementary school children girls and boys living in Chiba city. The photos of the selected sample of play equipments have shown to them. While looking on each photo they were asked to answer this question: “*what was your impression when using this equipment?*” or “*what kind of feeling or emotion did you have when using this play area?*” then the answers were recorded on a note. The results of this interview investigation gave us 72 keywords and phrase about the subjects’ impression expression. The derived *Kansei* keywords and phrases have been summarized into major *Kansei* descriptive words, which were 13 main keywords and phrases.

5. Analysis

5.1 Characterizing each of the resulted groups of equipments through the *Kansei* descriptive words relevant to the facilities belonging to the group

In this step the derived data of interview investigation from the *Kansei* keywords about play equipments expressed by children have been analyzed and clustered into the main groupings of impression words. The used

methods for the analysis are Quantification Theory Type III and Cluster Analysis. The distribution of the samples in the resulted grouping shows the character of each sample based on subject's impression.

As the output of analyzing the collected samples of play equipments and *Kansei* keywords, the chosen cut-off line for the clustering algorithm has yield 6 major clusters. Figure 4 show the cluster of the samples. The output graph of distribution of the samples and their grouping is shown in Figure 5 .The laid samples in the top and bottom of the graph tend to 'Ecstasy' and 'Pleasure', axis 'Y' is concerned with emotional aspects. But the distribution of the 'Exercise' and 'Discovery' from samples in the left and right sides of the graph leads to allocate axis 'X' for the structure of the physical and mental aspects of equipment. The resulted clusters are named as: C1: Fear, C2: Speedy, C3: Adventure, C4: Surprising, C5: Joy and C6: Exercise. The given name to each cluster is decided based on the characteristics play equipment and the activity, which is provided to children.

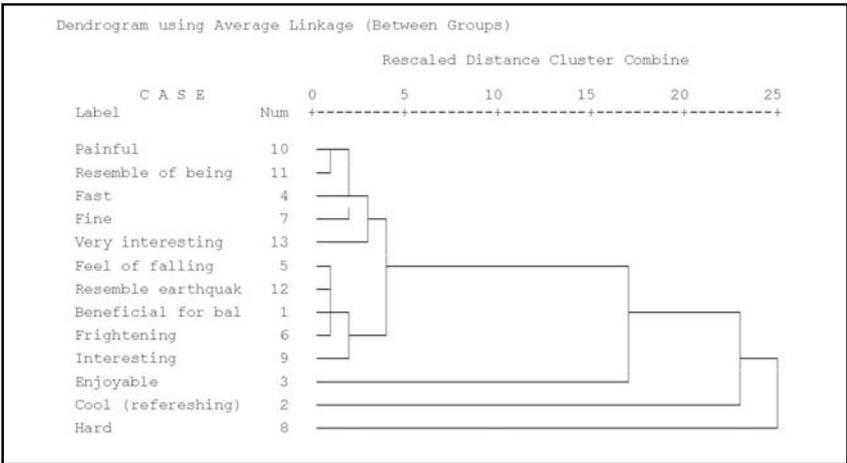


Figure 4. Clusters of Kansei keywords about play equipments samples

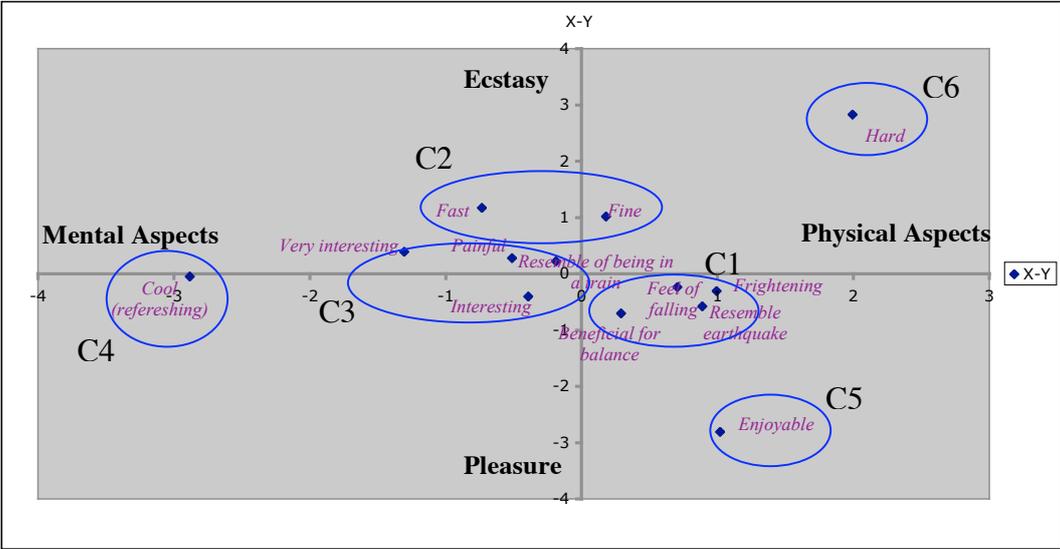


Figure 5. Distribution of the collected the Kansei words and the samples

The Cluster C1 (Fear) is placed in 'Physical Aspects'-'Pleasure' area of the graph. It can be described through a series of unstable feeling such as Fell of falling and frightening with enjoyable movements, which caused the subjects act in more physical activity on the play equipment while give the subjects feel of Pleasure. Such as

using the equipment like Suspension bridge. The C5 (Joy) is almost located in same area with Cluster C1 but it more near to 'Pleasure' direction of the graph. It presents more joyful feeling to children, such as the feeling caused when using a Chain climber.

The Cluster C2 (Speedy) is laid above the central areas of the graph near the 'Ecstasy' direction of the graph. It presents the regular activity such as sliding which is enjoyable and fast.

The Cluster C3 (Adventure) is settled in the central area of the graph on the 'Mental Aspect' direction. It consists of two groups of Kansei keywords which are in two different groups of emotional expression. Such as Painful and Very interesting, that is the reason for calling this Cluster as Adventure. It can be explain as the mental aspects feelings. The Cluster C4 (Surprising) is near the 'Mental Aspects' of the graph. It presents such feeling like surprising and discovery. For example when a child go to inside a tunnel and find it darker and cooler than outside. The Cluster C6 (Hard) is placed on the 'Ecstasy' – 'Physical Aspect' area of the graph. The most effective aspects of this group is the feeling caused by a tough effort, such as the feeling caused while going up on a Ramp. All the derived Kansei keywords from this investigation are shown in Table 4.

Table 4. The Clusters of Kansei keywords

C1: Fear	C2: Speedy	C3: Adventure	C4: Surprising	C5: Joy and	C6: Exercise.
Resemble earthquake	Fast	Painful	Cool (refreshing)	Enjoyable	Hard
Feel of falling	Fine	Resemble of being in a train			
Beneficial for balance		Interesting			
Frightening		Very interesting			

The samples of play equipments used in this research also has been analyzed and grouped with the methods of Quantification Theory Type III and Cluster Analysis and the output of analyzing the collected samples of play equipments and Kansei keywords, the selected cut-off line for the clustering algorithm gave us 9 major clusters. Some Cluster contains only one equipment, but some has more than one equipments. Shown in Figure 5. And the Table 5, shows the Cluster of play equipments' samples.

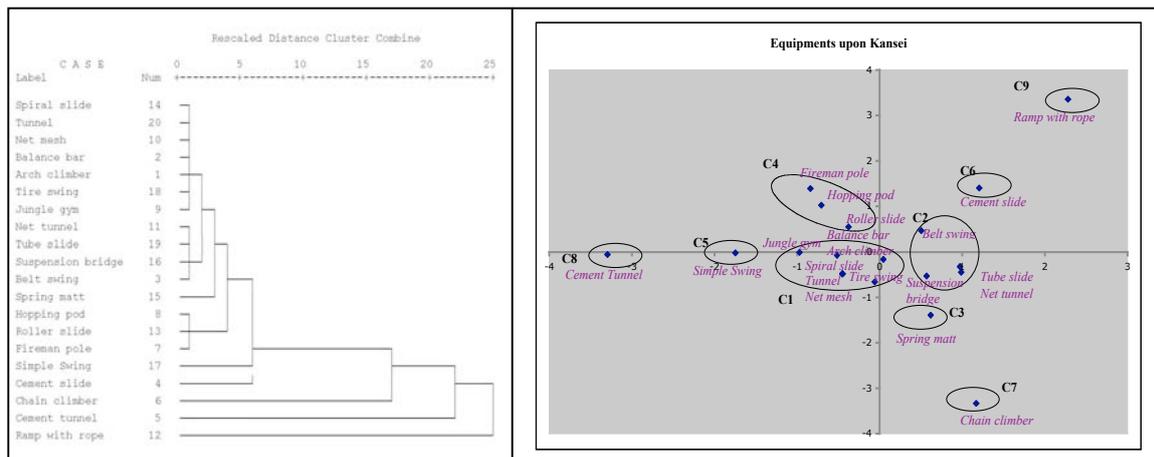


Figure 5. Clusters and Distribution of play equipments upon Kansei keywords

Table 5. The Clusters of samples of play equipments based on Kansei keywords

Cluster 1	Spiral slide	Tunnel	Net mesh	Balance bar	Arch climber	Jungle gym	Tire swing
Cluster 2	Net tunnel	Tube slide	Suspension bridge	Belt swing			
Cluster 3	Spring matt						
Cluster 4	Hopping pod	Roller slide	Fireman pole				
Cluster 5	Simple Swing						
Cluster 6	Cement slide						
Cluster 7	Chain climber						
Cluster 8	Cement tunnel						
Cluster 9	Ramp with rope						

6 Discussion and conclusion

In this case study research, the expressed Kansei keywords about outdoor play equipment can be classified into six Clusters named as Fear, Speedy, Adventure, Surprising, Joy and Exercise. Each of those groups has its particular impression for users. There is also a close relationship between the function and forms of play equipments and the derived Kansei keywords. The new design concept for the outdoors play equipments based on children's expressing Kansei emotional words can be create through a series of investigation with more subjects. For further studies it is better to focus on children group playing and social play at play areas, since one of the important parts of emotional feeling caused between two or more children.

7. References and Citations

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