**A Design Study through the Self-Report Emotion Measurement of Beach Bench Users**

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**Abstract**

**Emotion design is a very important research field due to the growing significance of sensible information communication between humans and products in today’s intelligent society. This paper conducted an emotion measurement on the users of Haeundae beach bench using self-report, to develop an emotion measurement method for design. The paper discovered the parts needing improvements in the self-report according to the measurement results and suggested implications for Haeundae bench design. This paper is expected to be used as a basic material for developing a new emotion measurement method in the future.**

***Keywords: Emotion measurement, Self-report, Bench design***

**I. Introduction**

*A. Background and Purpose of Research*

In this rapidly-changing society of 4th industrial revolution, emotion design is becoming a more important research topic as the communication of sensible information between humans and products.

Urban beach space not only provides a free leisure space to citizens and tourists but also makes people perceive an urban image and culture. Especially, public facility services on beach can have a huge influence on people’s satisfaction with beach. Thus, this paper sought to discover what improvements must be made in the existing “measurement environment” to develop a new emotion measurement method. To do so, this paper divided the existing emotion measurement through previous studies, compared and analyzed their advantages and disadvantages, and find ways to improve emotion measurement for beach bench users.

*B. Method and Scope of Research*

This paper selected self-report, an experiential measurement of the existing emotion measurement, to measure the emotion of beach bench users. Self-report does not have strict requirements for a measurement environment than physiological measurement and can measure more freely. Self-report measures the emotions of participants and is the most widely used emotion measurement. Therefore, this paper chose self-report for beach bench users to figure out what to improve in the existing emotion measurement. This paper chose the users of Haeundae Beach bench regardless of gender and age as its subjects.

**II. Theoretical Review**

*A. Definition of Emotion*

The term emotion is used in many meanings and is difficult to be defined in one word. However, according to the perspective of mechanical design engineering as in “Fig. 1”, it is a ‘highly advanced psychological experienced arising inside a human as a sense and perception caused by an external physical stimulation [1].



Fig. 1 Creation model of emotions

Pekrun defined emotion as an “integrated process or multiple elements of a sub-mental organization that includes emotional, cognitive, motivational, expressional, neurological, and physiological processes” [2]. Therefore, factors forming emotions could be divided into an external stimulation (human sight, hearing, touch, smell, and taste) and internal stimulation (recollection of an object or incident encountered in the past).

*B. Definition of Emotion Design*

An emotion design includes not only a functional and formative emotion response but also a symbolical emotional response obtained by understanding various meanings and values. It also gives emotional satisfaction to users and creates a cultural meaning and symbol. Thus, the purpose of emotion design is to stimulate a human emotion to have various communications between humans and target environments [3].

Thus, emotion design applies the characteristics and five senses of humans on design through a measurement and evaluation based on an objective interpretation. Also, emotion design in terms of product design is the contact between a user and product, thus a design formed by the communication of sensible information between a user and product through the user’s external and internal stimulation.

*C. Previous Studies on Emotion Measurement*

This paper searched “emotion measurement” as a keyword from previous research on RISS, KISS, NDSL, DBpia, etc. and found 7 most relevant emotion measurement methods among 6,590 papers as shown in [Table 1] below.

TABLE 1

Emotion measurement method

|  |  |
| --- | --- |
| Title | A Study on the Measurement of User’s Initial Emotion Measurement in a Product Use Environment  |
| Authors | Jae-hwa Lee, Geon-pyo Lee  |
| Source | Emotion Science, Vol. 13, No. 1, pp.111-120, Mar. 2010 |
| Measurement | \* Physiological measurement: EDA, Electrocardiogram, Pupillometry\* Behavioral measurement: Facial Coding System, Electromyography, Analysis of verbal characteristics. \* Experiential measurement: Meaning differentiation using emotion adjectives, Verbal protocol, Interview & Self-report |
| Title | Development of Self-report Question Criteria for the Measurement of User Emotions during Product Use |
| Authors | Sang-hoon Jeong |
| Source | Emotion Science, Vol. 10, No.3, pp. 403-410. Sep. 2007 |
| Measurement | \* Physiological measurement\* Psychological measurement: Adjective checklist  |
| Title | Emotion diagnosis chip (Emotion-on-a-chip, EOC): Evolution of bio-chip technology for the measurement of human emotion |
| Authors | Hyo-il Jeong, Tae-sook Gil, Yoo-seon Hwang  |
| Source | Emotion Science, Vol. 14, No. 1, pp.157-164, Mar. 2011 |
| Measurement | \* Measures verbal expressions\* Measures physiological signals |
| Title | Exploration of the Educational Usage of Emotion Measurement Technology |
| Authors | Chang-yon Lee, Young-hwan Cho, Hoon-ki Heung |
| Source | Journal of Korea Contents Association 15 Vol.15, No.8 |
| Measurement | \* Self-report emotion measurement\* Emotion measurement based on physiological signals \* Emotion measurement based behavioral responses |
| Title | A Study on Users’ Emotional Changes during Product Use using Emotional Vocabulary Logging Software |
| Authors | Sang-hoon Jeong, Geon-pyo Lee |
| Source | Emotion Science, Vol. 9, No. 3, pp. 167-177. Sep.2006  |
| Measurement | \* Physiological measurement\* Psychological measurement  |
| Title | Meaning Structures of Korean Adjectives for Emotion Measurement |
| Authors | Mi-ja Park, So-gil Shin, Kwang-hee Han, Sang-min Hwang |
| Source | Korean Journal of The Science of Emotion & Sensibility 1996, Vol.1, No.2, 1-11 |
| Measurement | \* Physiological method: Salivation, Galvanic Skin Response (GSR) \* Learning method by generalization of meanings or learning transfer\* Perceptual method, association method, scaling method |
| Title | A Study on the Development of the Measurement Tools for User Emotions expressed during Product Use |
| Authors | Sang-hoon Jeong, Geon-pyo Lee |
| Source | Design Study, Journal of Society of Design Science Vol. 64 Vol.19 No.2 |
| Measurement | \* Psychological measurement: Self-report, Interview\* Physiological measurement\* Measurement of User Emotions during Product Use  |

*D. Advantages and Disadvantages of the Current Emotion Measurement Methods*

The theoretical review of previous studies showed that the research on emotion measurement methods has been generally conducted by physiological measurement, behavioral measurement, and experiential measurement.

*D.a Physiological measurement*

Physiological measurement measures various physiological signals of humans such as pulse, heart rate, secretion, pupil size, etc.

(1) Electrodermal Response (EDA) Measurement: Most widely used among physiological response measurements [4].

(2) Electrocardiogram (ECG): Measures heart rate.

(3) Pupil Size Measurement (Pupillometry), Measures brainwave (Electroencephalo-gram), Galvanic Skin Response, etc.

*D.b Behavioral measurement*

Behavioral measurement measures a human’s gestures, facial expressions, voices, etc.

(1) FACS (Facial Action Coding System): Ekman and Friesen analyzed emotions from facial expressions [5].

(2) EMG (Electromyography) Measurement: Analyzes the movements of unconscious facial muscles and facial expressions [6].

*D.c Experiential measurement*

Some previous studies defined experiential measurement as a psychological measurement. Experiential measurement is the most widely used method in emotion measurement research.

(1) Self-report: Typically measures how participants feel about stimulation and asks several questions directly related to positive or negative emotional types [7].

(2) Self-Assessment-Manikins (SAMs).

(3) Affect Grid Model (Russell, 1989).

The advantages and disadvantages of physiolo-

gical, behavioral, and experiential measurements were compared, analyzed, and summarized as below.

TABLE 2

Advantages and disadvantages of emotion measurement

|  |
| --- |
| Types: Physiological |
| Advantages: - Can obtain objective data of measurement. - Can measure the unconscious emotional response  of users |
| Disadvantages: - Difficult to use expensive labs and equipment - Data analysis is difficult - Causes users’ unnatural thoughts and behaviors |
| Types: Behavioral |
| Advantages: - Can measure users’ natural expressions and  direct instinctive responses |
| Disadvantages: - Environmental factors are highly likely to  influence. - Difficult to objectively analyze  measurement results |
| Types: Experiential |
| Advantages: - Easy, simple  - Wide range of application |
| Disadvantages: - Highly likely to cause errors in results |

**III. Research Design**

*A. Self-report Survey Questionnaire*

The survey questionnaire was divided into 2 parts to measure the emotions of bench users in Haeundae Beach. Part 1 measured the emotional state of bench users by applying the 5-score criteria of emotional vocabulary, and Part 2 examined the preferences of bench designs and the factors influencing bench users’ emotions.

*B. Self-report Measurement*

This study was conducted from October 14th to 15th, 2017 in Haeundae Beach on beach bench users (regardless of gender, nationality, and age). A total of 98 survey questionnaires were distributed and recollected, and only 92 of them were used for final analysis after excluding the responses with not enough information.

TABLE 3

Overview of survey questionnaire

|  |  |
| --- | --- |
| Category | Details |
| Purpose | Emotion measurement of beach bench users |
| Period | October 14th to 15th, 2017 |
| Place | Haeundae Beach, Busan |
| Method | Self-report |
| Sample | 98 users of Haeundae bench  |
| Number of surveys for statistical analysis | 92 out of 98 surveys in total |

*C. Analysis of Measurement Results*

*C.a reliability and validity analysis*

The reliability of 7 survey questions on emotion measurement in Part 1 of this research was analyzed, and Cronbach’s α value was 0.785 for reliability.

TABLE 4

Reliability test (7 questions)

|  |  |
| --- | --- |
| Cronbach’s α | Number of Items |
| .785 | 7 |

In addition, factor analysis was conducted for the 7 survey questions, and KMO value appeared as 0.805 and was set above 0.70, securing the validity of variable selection. It is shown in [Table 4] below.

TABLE 5

KMO and Bartlett test (7 questions)

|  |  |
| --- | --- |
| Kaiser-Meyer-Olkin measurement of standard type relevance | .805 |
| Bartlett’ KMO test | Approximation chi-square | 165.156 |
|  | Degree of freedom | 21 |
|  | Significance probability | .000 |

*D. Research Results*

The results of Part 1 showed that 45.7% of respondents said the surrounding environment of the bench was “Quite good” while 17.4% of them thought “Very good”. However, 45.6% of the respondents said the bench design was “Slightly not good (32.6%)” and “Very bad (13.0%)”. To improve users’ emotional satisfaction, a design of emotional approach on bench designs is required.

The emotions of respondents were also measured using the 5-score criteria of negative and positive emotion words which included “Uncomfortable-Comfortable”, “Sad-Happy”, “Nervous-Calm”, “Boring-Fun”, “Stuffy-Pleasant”. Positive emotions had much higher scores than negative emotions.

The results of Part 2 demonstrated that the most influential factor on bench users’ emotion was the “scenery around the bench”, which took up 35.9%.

Also, “form” among bench design factors had the most influence on user emotions. The preference investigation on the material, form, color, and size of bench showed that “wooden”, “back bench”, “the material’s own color”, “2 to 4-persons seat” had a higher preference. These results are expected to suggest the direction of bench design in Haeundae beach for the future.

**IV. Conclusion**

This paper applied self-report and measured the emotional state of beach bench users to find the areas of improvement in actual measurement environment. This research has limitations because external factors such as weather, events, etc. can influence the users’ emotions in an outdoor environment including beach bench. Also, since it is difficult for the participants to express vague emotions in words on self-report, this research discovered that it cannot measure their emotions holistically and accurately.

In the future, it is necessary to develop a scale to evaluate emotions that users express freely, to measure their emotions during product use more accurately and validly. This paper is expected to suggest a direction and implications to develop an emotion measurement method.

**Acknowledgment**

This research was supported by BK21plus Level-up Project for Marine design team in Dongseo University

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