

Development of multi-sensory service system: focusing on the design of visual and auditory stimuli

In-chan Park¹, Go-eun Kim¹, A-ri Ha¹, Young-sam Min¹,

¹ TheDNA, 4th Floor, 114-44, Samseong 2-dong, Gangnam-gu, Seoul, Korea
{ In-chan.Park, Go-eun.Kim, A-ri.Ha, Young-sam.Min }royal@thedna.co.kr

Abstract. This study seeks to provide an understanding of multi-sensory services, exploring the comprehensive description of the development of augmenting multisensory technology for enhancing significant effects on the service industry, which our researchers implement. In addition, as a fundamental research on decision-making support technology for the optimal multi-sensory service, preliminary experiments were conducted to determine the influence of both single-sensory and multi-sensory stimuli on affect induction. The results of the preliminary experiments showed that multi-sensory stimulants combining visual and auditory stimulus had a more significant influence on a targeted affect than single-sensory ones. This offers the basis for the more effective tool of multi-sensory stimulus as inducing affect.

Keywords: Multi-Sensory, Service System, Visual Stimuli, Auditory Stimuli

1 Introduction

Multi-sensory based service offers various single-sensory stimuli within the same framework of service. In general, the sensory organs were interdependent and inter-stimulus, so they had a greater influence on affect when several sensory organs functioned at the same time. However, there is a shortage of empirical research and its verification for the general fact.

This study provides the overall understanding of multi-sensory service, exploring the comprehensive description of development of augmenting multisensory technology for enhancing significant effect on the service industry, in which our researchers implement. In addition, as a fundamental research on decision-making support technology for the optimal multi-sensory service, the study examines of how both single-sensory stimulus and multi-sensory stimulus induce the affect through experiments.

2 Overview of Multi-sensory service for enhancing the service industry

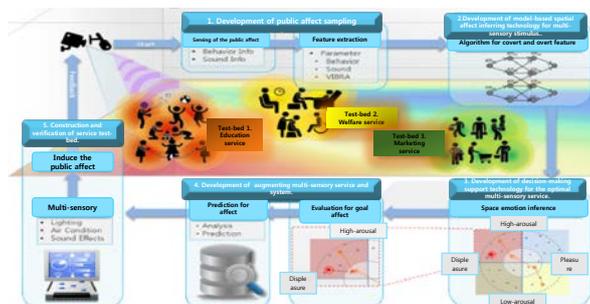


Fig. 1. Flow-chart of multi-sensory service for enhancing the service sector

The goal of this project is to develop multi-sensory based service technology for the enhancement of the target effects (positive effects) of service users). Figure 1 shows a flow-chart of multi-sensory service for enhancing the service sector. The project consists of five core components of development: 1) Development of public affect sampling, 2) Development of model-based spatial affect inferring technology for multi-sensory stimulus, 3) Development of decision-making support technology for the optimal multi-sensory service, 4) Development of augmenting multi-sensory service and system, and 5) Construction and verification of service test-bed.

3 The relationship between the senses (visual/auditory) of affect

Stahi (2005) applied color circle (Itten, 1971) as a tool indicating the relationship between color and affect. After turning Itten's color circle 90 degrees in a counter-clockwise direction and combining Russell's circumplex model of affect, the research explored the relation between color and affect. Jung Dae-hyen and Han Kwang-hui (2007) used the simplest form (triangle, rectangle and circle) of two-dimensional figures to conduct a study on the change in affect. The study found that in terms of the difference among figures, pleasure was defined at a point of the approximate circle and high-arousal was defined at a point of the approximate triangle. At the inclining direction, pleasure and low-arousal were displayed. When the ratio of width and height was 1:1, high-pleasure and low-arousal were represented.

A study on tonality and emotion found that while a major key represented bright, pleasant Positive Affect, a minor key depicted dark, sad Negative Affect. A study on rhythm and emotion showed that while rhythm with quick tempo evoked Positive Affect, rhythm with slow tempo induced Negative Affect. And it indicated that an irregular beat aroused tension and excitement (Lee Hong-jin, 2010).

In Russell's circumplex model of Affect, the horizontal axis indicates pleasure-displeasure and the vertical axis shows high arousal-low arousal. In the horizontal axis, pleasure is defined at a point of the approximate west and displeasure is defined

at a point of the approximate east. In the vertical axis, while high arousal is defined at a point of the approximate north, low arousal is defined at a point of the approximate south.

4 Preliminary Experiment

4.1 Preliminary experiment 1 method and results

The objective of this preliminary experiment 1 is to determine whether the visual, auditory, and visual-auditory stimulus induce the targeted emotion, based on preliminary research and case studies on the characteristics and emotion of figure, color, and sound. To that end, four stimuli (two visual stimuli of pleasure-high arousal and pleasure-low arousal, two auditory stimuli) were made. Table 1 demonstrates specific properties of visual and auditory stimuli used for the experiment.

In the preliminary experiment 1, a total of 100 people aged 20~60 (male: 52, female 48) were randomly allocated as four groups. Each group was exposed to one visual and auditory stimuli of pleasure-high arousal and pleasure-low arousal. And then, affect from the relevant stimulus was applied to Russell's circumplex model of affect. Subjects were told to select one adjective what they felt among 12 mood adjectives representing pleasure-high arousal, pleasure-low arousal, displeasure-high arousal, and displeasure-low arousal.

Table 1. Sensory stimulus components for inducing affect

Division	Visual stimulus	Auditory stimulus
Pleasure-high arousal	Equilateral triangle with round sides,	Major key, 132bpm(fast tempo), irregular pattern
	Rotate 0,90,180 degrees, RGB:255.200.0,	
Pleasure-low arousal	Circle, no rotation of figure, RGB:150.200.50,	Major key, 56bpm(slow tempo), regular pattern

The results of this experiment demonstrated that while 8 subjects (32%) of 25 selected visual stimulus of pleasure-high arousal and 11 subjects (44%) of 25 chose visual stimulus of pleasure-low arousal, 8 subjects (32%) of 25 people picked auditory stimulus of pleasure-high arousal and 14 subjects out of 25 selected auditory stimulus of pleasure-low arousal.

4.2 Preliminary experiment 2 method and results

To that end, two multi-sensory stimuli were made by combining visual stimulus and auditory stimulus of pleasure-high arousal and pleasure-low arousal that were used for the experiment 1.

In the preliminary experiment 2, a total of 100 people aged 20~60 (male: 50, female: 50) were randomly allocated as two groups. Preliminary experiment 2 were used the same method used to preliminary experiment 1.

The results of this experiment demonstrated that 22 subjects (46%) of 50 selected multi-sensory stimulus of pleasure-high arousal and 33 subjects (66%) out of 50 chose multi-sensory stimulus of pleasure-low arousal. The experiment 2 found that in the case of resulting in a higher targeted affect than the preliminary experiment 1 using single-sensory stimulus. The experiment indicated that multi-sensory stimulus had a more significant influence on affect than single-sensory stimulus.

5 Conclusion

This study provided an overall understanding of the ultimate goal for the project, exploring the explanation of the development of augmenting multi-sensory technology for enhancing significant effect on the service industry. In addition, as a fundamental research on decision-making support technology for the optimal multi-sensory service, the preliminary experiments were conducted to determine the influence of both single-sensory stimulus and multi-sensory one on affect.

The results of the preliminary experiments demonstrated that multi-sensory stimulus (combining visual stimulus and auditory one) produced a higher targeted affect than single-sensory stimulus.

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