

Research of Interactive Product Design Method Based on Synesthesia Materialization

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Abstract. Recently years, designers pay more attention on interactive design between users and products, especially on emotional design. This paper deals with the research of interactive design based on synesthetic approach. After analyzing the synesthetic relation of five sense organs, we discuss the method which can make synesthesia materialize by using sensor technology, and can establish a good communication channels between users and products. Finally, we prove that, with this method, designers could come up with conceptual proposals based on natural objects.

Keywords: Synesthesia, Interactive design, Emotional design.

1. Introduction

If sound can be perceived by sight, and taste by hearing, then what is the scene in front of you? You may feel the musical notes with colour, songs with all tastes. Is this an illusion? This article studies the interactive method based on synesthesia which lead the users into a place where they can not only feel the direct feelings but also the additionally synesthesia. When using these products, receiving the synesthesia senses, users can materialize the feeling in mind, and the delightful sentiment emerges.

Synesthesia is a neurological condition in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway.^[1] It is possible to enhance creative thinking capabilities and inspire people's imagination through the method of synesthesia. Creative thinking capabilities which based on synesthesia have been applied into various fields, such as music, stage design, and graphic design. But research about how to bring synaesthesia materialization and communicate to users is few.

To cope with the problem which most products are cold, lack of emotion with user, nowadays the emotional design has be highlighted by designers. Emotional products can always build the connection between product and user, bring amused experience to users. According to the emotional design theory given by Donald Norman, reflection layer of the product can trigger the user's deep thinking.^[2] This paper attempt to help user establish the emotional connection with product through synesthesia experience, at the same time, emotional experience exists in the reflection layer is established.

2. Emotional Interactive Design Between Users and Products

With the humanized design concept proposed and development, people take more emphasis on emotional product design. Norman asserts that the emotional side of design may be more critical to a product's success than its practical elements. His fundamental thesis is that attractive products work better. He contends that beautifully designed products make people feel good, which in turn puts people in an open frame of mind to be creative and find solutions to the problems they face.^[3] Emotional experience exists in

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the reflection level which is designers convey emotions into the products, and help to establish a communication channel between users and products through the meaning of the shape and the interactive behavior. Such as Muji CD player: User pulls the rope, therefore the CD rotates and plays music which evokes memories of childhood.

The features of the interaction design which can build emotional experience are:

- Unique and comfortable sense enjoyment
- Experience fully geared to users' behavior or habit
- Giving rise to users' memories
- Creativity

3. Synesthesia

3.1. What is synesthesia?

Synesthesia is a neurologically based condition in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway.^[4] For example, some people have the capacity of color-voice synesthesia will associate light color when he or she heard high-pitched voice. Some other people could listen to the taste of potato.^[5]

By the mid-nineteenth century synesthesia had intrigued an art movement that sought sensory fusion, according to Cytowic.^[6] It has been proved that each region of human's brain control one sense by PET(PET,Positron Emission Tomography), therefore the phenomenon of synesthesia will be occur when two different regions merge with others.

3.2. Characteristic

Cytowic argues that such deliberate contrivances are qualitatively different from the involuntary experiences that I am calling synesthesia in this review. He defines synesthesia as the involuntary physical experience of a cross-modal association.

- Momentary: it is hard to make conscious sense get the level of conscious for most people.
- Memorable: Usually, the conscious of synesthesia be remembered easily than the first sense for some object.
- Emotional:The conscious of synesthesia may produce pleasure reactions.^[7]

3.3. Relation

On the one hand, following previous studies, there are special connections of synesthesia among human five sense organs—from one sense to another sense, or from one sense to various senses.^[8] (1) Two sense organs: vision and taste sense, sound and color (2) Three kinds: time-space-emotion. The transfer of sense can be single-tracked or multi-tracked, unidirectional or bidirectional.

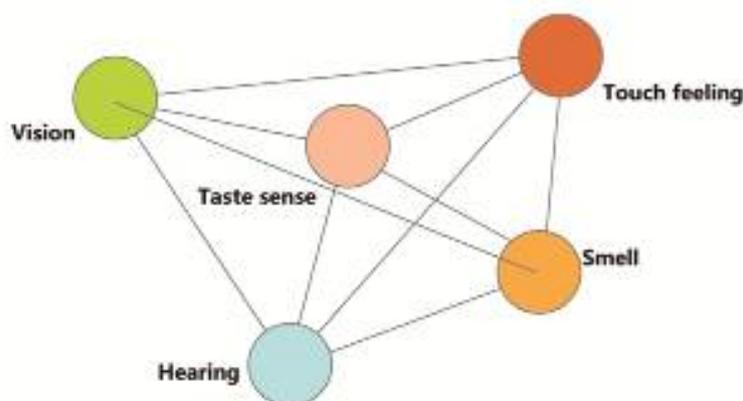


Fig. 1: The relation of synesthesia sense

3.4. Synesthesia Materialization

The application of synesthesia contributes to enhance artistic expression abilities and the user comprehension. Until now, it is really few that systematized method of product design which based on sensible synesthesia. This kind of design method will bring us pleased interactive experience by the sensible synesthesia. For instance, LG mobile phone which named chocolate gives off a nice smell frequently because of its material, so that users feel it amazing.

The method of making synesthesia materialization: combine with sensor technology and appearance design.

Table. 1: Sense expression

Type of sense	Receive form(human)	Form of expression(product)
Vision	Image, light, color, video	Shape, color, material, video, light, shadow
Hearing	Music, voice	Music, feedback voice
Touch feeling	Texture, temperature	Material, temperature
Smell	Smell, aroma	Aroma
Taste sense	Flavor	Flavor

4. Interactive Product Design Method Based on Synesthesia Materialization

4.1. Design Method

1. Picking up sense organs' features of one natural object and finding its synesthesia sense organs.
2. Expressing the basic sense and synesthesia sense: How to convey the basic sense and synesthesia sense by function and appearance of products, namely product characteristic.
3. Integrating characteristics with synesthesia characteristics of product by sensors and appearance.
4. Finishing a complete interactive product proposal: appearance, interactive processing, circuit and physical construction.

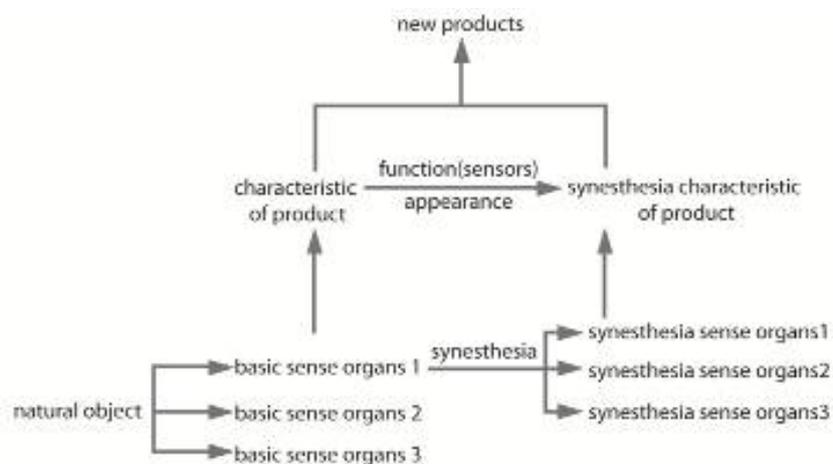


Fig. 2: Interactive product design method based on synesthesia materialization

4.2. Application of method

We found four designers to test this method, and asked each of them to choose one object which has been wrote in the list, and design an interactive product according to the synesthesia method described previously. They must be promise to spend less than 15 minutes. And the design results in the table below:

Table. 2: Test for designers

Designer	Step1 Object	Step2 Basic sense	Step3 Synesthesia sense	Step4 Characteristic of product	Step5 Combine characteristics	Step6 Conceptual proposal
Wu Jia	windmill	rotate	music	Windmill and voice box	Analyze the music rhythm and control rotate speed of windmill	A voice box, looks like windmill which rotates with music and its speed stay with rhythm.
Shi Yiyang	window	light	color	Sunlight spreads into window, color of building	Sensors induct luminance of sunshine, control color of window	Curtains change color because luminance of sunshine.
Zhang Yiran	flower	flower	flavor music	Shape like a flower, alarm by music and flavor	light sensor control playing music and expiring fragrance	Flower wakes us up, when sun rise, flower clock playing music and expiring fragrance.
Huang Chenli	puddles of water	Splashed Some Water	Splendid light	Rain shoes and Splendid light	Pressure sensor and humidity sensor control flashing	One pair of romantic rain shoes. When users step on the puddle, shoes will be flash.

5. Sample-Melody fish tank

5.1. Concept Description

A communication method between people and fishes: The sensor be installed in fish tank could induce the size, location and swimming speed of the fishes, and express their emotion in music. In traditional way, people can only enjoy fishes swimming by the tank, and feel their emotions by their ‘dance’. Sometimes, people seems hearing fishes singing because synesthesia. This interaction design is for this purpose that making the synesthesia dematerialized, bringing people multi-sensoried interactive experience. The scene of the swimming of the fishes completely correspond the melody, the size, swimming speed and location control the rhythm and frequency of melody. This design makes people having a good relax and produces a beautiful association by Synesthesia. The process of design is like picture below:

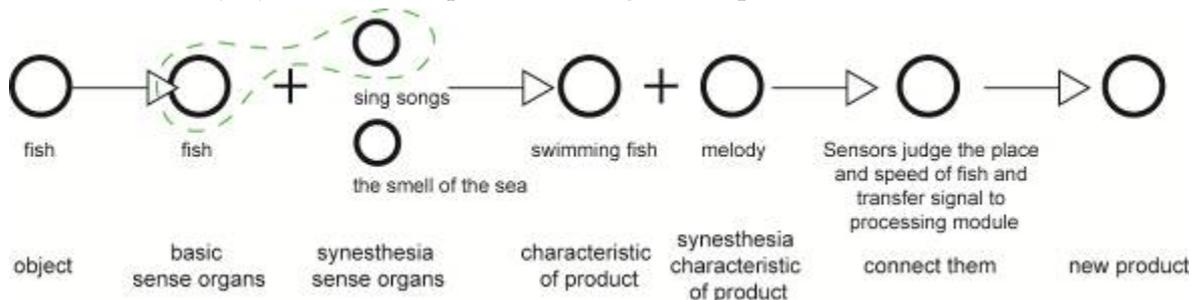


Fig. 3: Design process

5.2. Design Objective

1. Enhance communication between human and nature

The feelings of people to the nature is innate, people have been longing for interaction, communication with nature. For example, some children will talk to a hole of tree, and others want to touch the soft white cloud. The aim of fish tank design is shortened the distance between people and animals by feeling emotions of fish.

2. Application of synesthesia method

Trying to design an interactive product based on synesthesia method which is discussed in this paper

5.3. Description of the principle

5.2.1. Technique principle and composition

1. Fish tank: This shell of fish tank includes glass cover, top cover and bottom case. Infrared sensor and processing module has been placed in top cover.
2. Infrared sensor: Sensors will judge the place and speed of fish and transfer signal to processing module.
3. Processing module: Processing module will receive signal from infrared sensor and control melody which correspond with speed and position of fish.

There are structure chart, circuit diagram and product photos below:

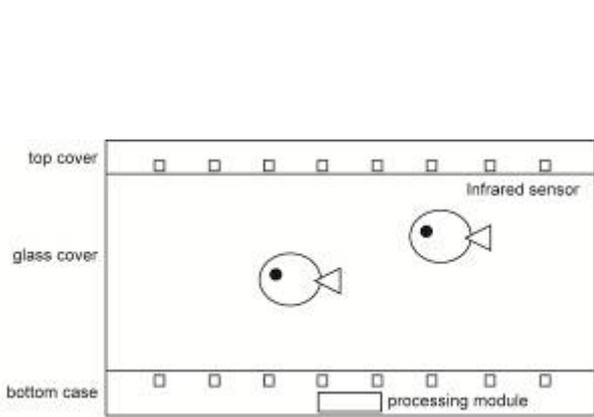


Fig. 4: Composition of tank

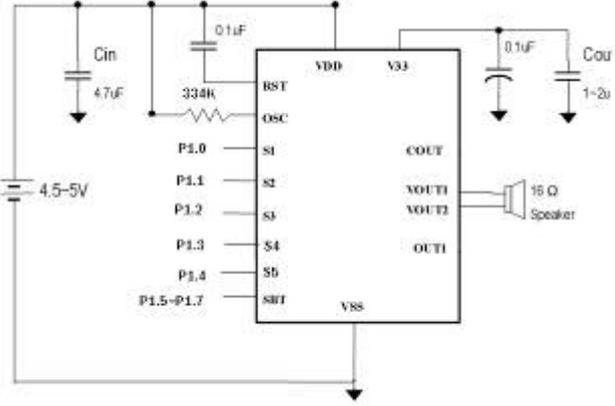


Fig. 5: Circuit diagram



Fig. 6: Product photos

5.2.2. Synesthesia principle

The research of music psychology has indicated that sound frequency connect with position, color, size, motion speed and so on. [9]

Table. 3: Synesthesia principle

	sound frequency-high	sound frequency-low
spatial location	up\high\far\deep	down\low\near\ superficial
shape	small	big
motion speed	fast	slow
color	Warm color	Cold color

6. Conclusion

In this paper, we found a method to design interactive product based on synesthesia and demonstrated this method is effective by design testing. Each designer come up with interactive product ideas successfully in 20 minutes. As a complete project, we finished an intelligence fish tank model, and some visitors expressed curiosities when they were watching singing fishes in our little show. Thus, this method could help some designers to do their interactive design, especially emotional products.

7. Acknowledgements

We would like to thank Qin Duyin, ZhangYu, Dr. ChengYao, and our colleagues for their contributions to the prototype.

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