

## **Understanding HCI in aesthetic way: a new approach to interaction feature study**

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*Abstract: The aim of this study is to explore the interactive relationship or behavior between human and products, which is the main object of interaction design study. In order to support the design practises, the study started the process with interaction itself, including the definition and description of interaction feature. Furthermore, the study also focused on the relationship between interaction feature and user experience. This study started with observing users' behavior in daily life and explore the meanings of product functions in an aesthetic way. With two experiments, a framework of interaction feature has been established including the behavior, relationship, procedure and experience. Moreover, based on this framework, designer can understand how people experiencing, comprehending fuctions directly and which will help the designer to build a better interaction experience system.*

*Keywords: Human computer interaction, feature, aesthetics, user experience.*

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### **1. INTRODUCTION**

With the development of intelligence products, the userface has changed by new technology materials, from the original command user interface (CUI) to graphical user interface (GUI), now with the application of intelligent devices, such as smart phone, kinect, X-box and leap-motion, which expanding the interactive behavior range of user interface and promoting a new user interface named nature user interface (NUI) [1]. Such devices and technologies allowed new interactive ways like movement-based controlling. The concept of gesture has played an essential part in movement-based interaction, like finger, arm, head and body movements which is spontaneous in interaction procedure and formed a natural communication channel. Moreover, in NUI context, the interface has transformed from two-dimensional to three-dimensional spatial interface. Gestures can be considered as one of the natural interaction channel, which provides more opportunities for designers to create new behaviors and relationships in human computer interaction.

In NUI design study, the new technologies have formed a development trend in aestheticization of information tools [2]. Many researchers have established a plenty of studies to explore the HCI design methods based on pragmatist aesthetic theory [3]. With Dewey's discription of pragmatist aesthetics, the central part of pragmatist aesthetics is aesthetic experience with no accurate definition about what an aestehic experience is [4]. Such ineffable experience is difficult to analysis or definition, an important issue is how to seek the ineffable experience in interaction procedure, in which aesthetics and image schema acted as one of the key points to build such kind of experience [5].

In this study, we bulid two experiments to acknowledge the final framework about interaction features. The first experiment was to observing user behavior in daily life and collected their behavior features, with analysis work a life-based archetype database has been established. The second experiment, we invited some dancers to use their professional skills to creat interactive movements based on the life-based archetype. With Laban movement analysis [6], the dancers' movements had been abstracted and analysed. After the two experiments has been finished, a framework about interaction feature description has been completed. The results of two experiments will help designers to understanding how user comprehending fuctions and relationships between user and products.

## **2. RELATED WORKS**

### **2.1 Interaction attributes and components**

Facing with various complex interaction problems, designers also need to describe the interaction issue, including the objection, content, relationship and procedure and so on. Many researchers also tried to make description or definition about interaction qualities and elements, such as exploring the relationship between interaction attributes and emerging experience [7]. Some has extracted a set of interectivity attributes based on gestalt theory and throught experiments to confirm these attributes could be recognized and then produced more meaningful emotional reflects, which could be seemed as a tool to create interactivity conceptually [8,9]. In this research part, the concept interaction is a boarder object than our present research, in another word, interaction is more complicated than interactivity. It doesn't mean our research only focuses on interactivity, we adopted Lim's method to explore the invisible qualities of interaction and its relationship to user experience, which give us a framework to collect and analysis dancer's subjective descriptions.

### **2.2 Pragmatic Aestehtics and aesthetic interaction**

Interaction design research is now becoming more and more important, because when facing at so many different kinds of interaction design, now we can find the intelligent devices has changed our behaviors by different forms of interactivities. An essential point is with what kind of interact or how interact with user can produce an aesthetic experience. Related studies about this can be traced back to Dewey's studies about pragmatism aesthetic. The term aestehtics is created by Axlander Baumgarten in the 18th century which was derived from Greek aesthesis [10]. In the later of 18th century, in Kant's philosophy, the aesthetic experience came from

contemplating art or nature and without any goal outside, such experience only appeared from its own sake [11]. The analytical account of aesthetics has its own formal approach and applied its studies into universal aesthetic laws which has been applied in forms of art and design. In the 1930's, John Dewey distanced his study from the analytical aesthetics and promoted a pragmatic aesthetics instead, Shusterman built on Dewey's philosophy theory. The central of pragmatic aesthetics is the aesthetic experience and there is no final description about what an experience is, because use words to describe accurately an aesthetic experience is impossible [12]. However, according to Shusterman, there are still some characters can be outlined about the pragmatist approach to aesthetic [13].

Firstly, from pragmatist way, the aesthetic has practical use, especially in industrial design. Secondly, the object of aesthetic experience must under its own socio-cultural context. Thirdly, form is linked with the aesthetic experience. The last one, an aesthetic experience involves the whole human actively. Based on such characters, when begin an interaction design program, the designer should consider practical use, socio-cultural context, form with aesthetic experience and activated human as the most important essential. As Petersen mentioned, aesthetic experience is an essential interdependency between body and mind experiences [14], and the aesthetic interaction emerges from personal and interpersonal sensations, reflections and experiences that connected to a system [15]. Our study which built on these theories has a definite framework about how to start and analysis interaction with aesthetic approach.

### **2.3 Life-based prototype**

A prototype is an early sample, model or a product which built to test a concept or process or to be act as a thing to be learned from [16]. Prototyping serves to provide specification for real, practical use beyond theory-based research [17]. Prototype is applied in many field, such as engineering science, computer programming/computer science, natural sciences and so on. For our study, life-based prototype is like a reference for interaction design, like how we understand and practice the functions in daily life, is there any relationship between computer functions and human acknowledge, what is the functional related prototype like, with what form. Only after we have collected prototypes and analysis those prototype data, the results will provide the functional experience with different forms and interaction.

### **2.4 Body as an aesthetic approach**

Based on pragmatic aesthetic study and Shusterman's extending descriptions about the aesthetic experience, a new aesthetic theory had been created by Shusterman named "Pragmatic Somathetics" which put the body experience as the key factor in aesthetic experience. Pragmatic somathetics also suggestion use different ways to make promotions about the related effects of body and experience, with these methods we can improve our experience quality and body experiential ability. Many researchers have explored various experiments or methods to analysis the interaction. Klooster firstly proposed Choreography of Interaction as a design method to explore movement-based interaction, which is built up a new research pattern to design new interaction [18]. Built on these aesthetic studies, additionally, the body experience and awareness were taken as a starting point of design as kinaesthetic,

which gives us self-perception and the felt sense of our bodies in dancing process [19]. Ross has designed a dancing experiment which the choreographic dancers acted as an intelligent lamp and interacted with users under different contexts, the result of his experiment was an intelligent lighting product based on the aesthetic experience produced by the dancers' created interaction [20]. Jung conducted a series of experiments about the interaction produced between dance and graphics [21]. More and more researchers have paid attention to the aesthetic experience study, especially on interaction feature study and these studies show a signal that using dance as an approach to explore the body movements, motor experience and emotional affections produced by body [22].

In the second experiment, the dancers' professional skills created various movements in the interactive procedure which expressed their original experience both from their physical force and psychological force, with their beautiful body movements and subjective descriptions about their own experience during dancing experiment. The result could help us find the movement's feature and its related emotional experience.

### 3. EXPERIMENT

#### 3.1 Experiment 1: Life-based archetype

For our first experiment, we started with 12 groups which were consisted of interaction designers, they all have more than 2 years experience on interaction design, including user interface design, gesture design, interaction process design, service design, user experience design and so on. Every group has 4 members, each group has a computer functional word to explore based on daily life. Every group has record device like camera and video camera to collect their findings which are related to the group's word. The experiment provided selectable words are as follows, which are all come from common computer functional words:

- |                 |               |                    |
|-----------------|---------------|--------------------|
| 1. Input/Output | 5. Paste      | 9. Share           |
| 2. Move         | 6. Play/Stop  | 10. Collect        |
| 3. Delete       | 7. Open/Close | 11. Volume control |
| 4. Copy         | 8. Next       | 12. Switch         |

The experiment had sustained about 2 months, we had not put any limitations about the contents they may find. After the experiment ended, we had collected 12 videos, each video contains at least 10 different kinds of behaviors which was related to the word selected by group. We analysed the video materials and tagged the behaviors in different categories, the results are collected by pictures, see Fig.1.



Fig. 1 Results of Input by life prototype

From the result example we can find three characters from life prototype:

The first is there are different forms to express the same word, from fig.1 we can find the word input has three different forms, the airflow input makes the pinwheel work, the force input draws a beautiful wood engraving, the light input by the candles' transmit. The second is such forms of input are all from daily life and make people happy or pleasure. The last is we can find different features from behaviors as references when design interactive behaviors.

### **3.2 Experiment 2: Interacting Dance**

#### **3.3 Participants**

In this experiment, we chose six interactive features of the music player (with volume control, switch, play, stop, share, collect) as the research cases which also were part of the words in the experiment 1. Eleven dancers (5 male and 6 females) were invited to participate in this experiment to create and perform the movements they created. All the participants have more than 5 years professional training experience and their average age was 31.3 (N=11, SD=2.629). The dancers we invited were professional and had experience of performance and choreography.

#### **3.4 Recording equipment**

The dancers' creating process and body movements were audio-video recorded. There were 4 digital video cameras in the observing lab: two cameras were placed in the dancer's back to obtain the dancer's movements and the the third one was placed in the right position record the detail movements by arm and hand; the last one was in front of the dancer for obtain the whole dancer's movement. The dancer was asked to create movements of the six interaction tasks with arms and hands. Every dancer was free to permitted to the experiment space without any limitation. Moreover, the dancers' clothes were in dark and the background was also black, only the hands and arms were exposed for we could record the detail movements more clearly and it is convenient for us to process video in the next part.

#### **3.5 Creating motion history images**

The approach to creating motion history images is shown in Fig. 2. The motion history images were composed of two images: an overview of the body history images and an overview of the hands history images. First of all, the original image is preprocessed by convey to gray except hands and arms with the Real-time color version of the technique [23], then use edge detection algorithm to find the contour of dancer's body curve in the image (Fig. 2).

The goal of the process procedure was to abstract the motion history of hands and arms by simple line trajectories. For getting the trajectories of movements, we averaged each of the pixel frames of the processed video and overlaid these frames next to another with the three angles which are taken from the cameras, see Fig.3. According to the method of Laban movement analysis method suggested, the movements can be described on the basis of limb termination. In another word, from one point to another point in the space by body movements, thus a created movement by arms and hands could produced a determined trajectory by finger with our method to process the video. We draw along the limb based motion history image with simple lines. We also used a grid to help to confirm the range and position to make the line more accurately.

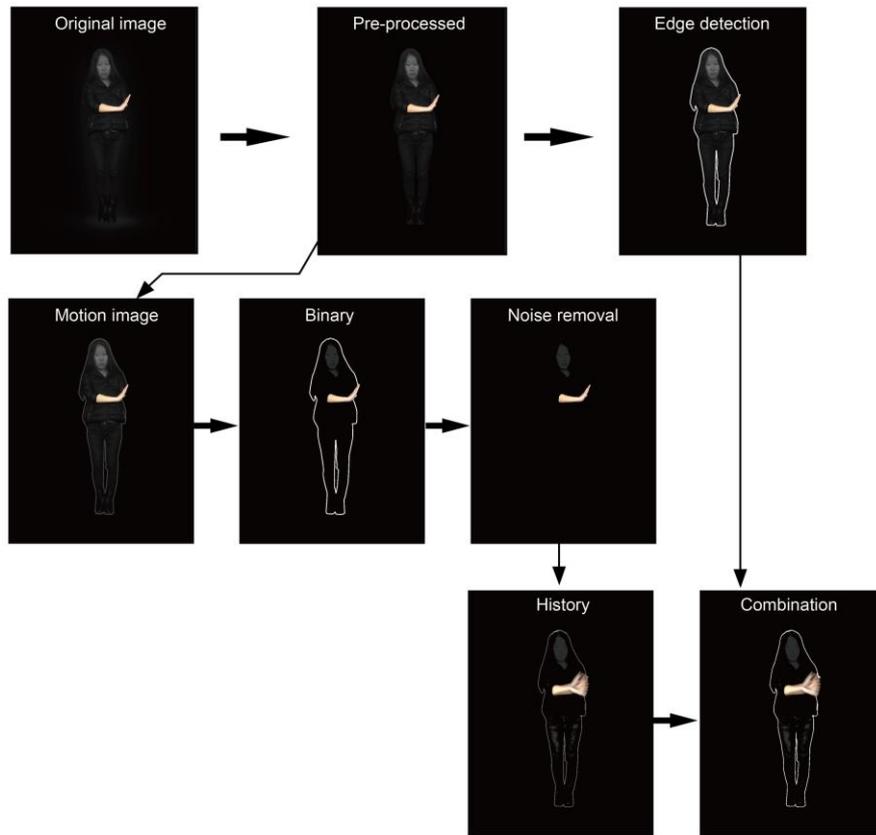


Fig. 2 The pre-process of motion history image

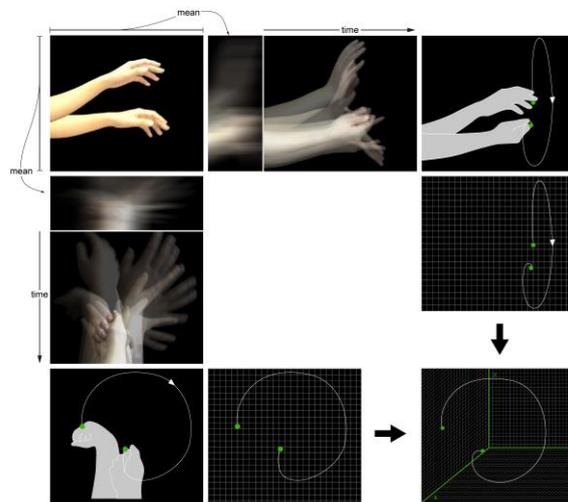


Fig. 3 The process of abstracted line based on movement

#### 4. RESULTS

The two experimnts gave us a clear and abundant materials to bulid an analysis framework of functional-based interaction features, see Fig.4. In this framework, we analysis the dancers' movements and their subjective description about how they express the content of every function. We also analysis the descriptions form two experiments and catagoried the key words by noun, verb and adjective. For By the category results, we can find the interaction features

through context dimension, behavior dimension and relationship dimension, every dimension has its own features. For example, volume control in relationship dimension may have positional relation feature, energy feature, quantitative relation feature.

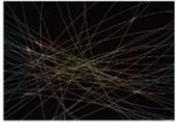
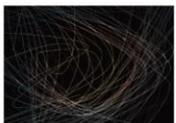
| Function       | Motion Trajectories   | Description Vocabularies<br>NOUN         | Description Vocabularies<br>VERB                    | Description Vocabularies<br>ADJECTIVE                             |
|----------------|---|--|---|---|
| Volume control |  | A conductor<br>Water ripple<br>Elastic   | Jump<br>Balance<br>Expand and contract<br>Press     | More and less<br>Heavy and light<br>Up and down<br>Big and small  |
| Switch songs   |  | Door<br>Book<br>Camera<br>Whirligig      | Change<br>Turning<br>Selecting<br>Flashed<br>Reject | Front and back<br>Before and after<br>Here and there<br>Otherwise |
| Play           |  | Wind and windbell<br>Knob<br>Lamp<br>Gun | Forward<br>Move<br>Go on<br>Action<br>lighting      | When<br>Suddenly<br>Then<br>Fast                                  |

Fig. 4 A part of the analysis framework of functional-based interaction features

## 5. CONCLUSION

Based on the two experiments we finished, an analysis framework of functional-based interaction features was built, which could give us more references during the interaction design research and practice.

Our study started with the theory of pragmatic aesthetics, which suggested us to explore and find what an abundant experience is. It is different from traditional industry design research, which mostly focuses on visual and practical use, in interaction design research field, the essential key point is user experience, what is user experience, how does the user estimate an experience, how to design an aesthetic experience. The pragmatic aesthetics thought an aesthetic experience must be completed, which means the experience must include abundant content, the subject should experience the whole content. Although Dewey had not given us the accurate descriptions, we also can explore from our daily life.

In accordance with our experiments' results and the framework, it is the beginning method to explore interaction features with an aesthetic approach. The dancer's professional skill and body movements are an aesthetic way to explore aesthetic behavior, the descriptions and the daily life findings could provide more materials to understand the aesthetic experience.

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