

# Chapter 2

## Metaphor-Based Interaction Design in Lighting Area

Xing Gao and Liangzhi Li

**Abstract** In this paper we present Tangible Light, a simple tangible light that use behavioral metaphor to convey meaning in its interaction design. Our purpose is to take advantage of natural physical metaphor to achieve a heightened seamlessness of interaction between people's behavior and information they want to send. At the same time we attempt to make control system invisible with embedded sensors. So here we explore a hypothesis that coupling of emotion and action in an interaction designed for metaphor and simplicity while manipulate a digital light as an instance.

**Keywords** Tangible interaction • Metaphor • Human senses • Intelligent lighting • Sensor technology

### 2.1 Introduction

In the last few decades, the trends of lighting device design are considered with more humanism and meaningful. Norman had summed up product characteristics in Emotional Design with three levels: Visceral design (Appearance), Behavioral design (using pleasure and effectiveness), Reflective design (Self-image, personal satisfaction, memories) [1]. Thus while thinking about interactions with objects

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where one communicate to use we turn to think about how to map interaction in a meaningful and comprehensive manner when manipulate objects. As machines become more and more capable, taking on many of our roles, designers face the complex task of deciding just how they shall be constructed, just how they will interact with one another and with people [1]. By the way, Bill Moggridge, the founder of IDEO, brought the conception of interaction design in the 1980s. He believes that products should have the function of interaction, which means in the using process, users can get emotionally involved through the exchange of information with products, and that designers are supposed to adopt the method of interaction design to work out a “simple, useful, and enjoyable interactive product” [2].

One prominent area where we would like to see interface expressivity thinking applied is consumer devices [1]. In this section our work is focused on exploring how to let people use their natural behaviors to communicate with the light device, instead of the traditional switch. As a prove instance, we rely on manipulate light which is an appliance that used in daily life [3]. Thus we hope to shorten the gap between a user’s goals for action and the means to execute those goals which Hutchins, Hollan, and Norman described this as the gulf of execute, which on [4].

### ***2.1.1 Relate Work***

We present several related work based on consumer device by using novel approaches to turn communication to become intuitiveness. For example, the Marble Answering Machine is a classic example which influenced many following research. The user can place the marble which hold the message onto an augmented telephone, then dialing the caller automatically [5]. Another project is focus on how to naturally control a device, for example a bottle shape is chosen, and then opening the bottle by pulling out a cork is a well-understood mechanism [6]. And That MIT Media Lab did recently is a Speak Cup, a simple tangible interface that uses shape change to convey meaning in its interaction design [7]. Other research institutes also pay attention to this promising field, such as Potsdam University of Applied Sciences explore a series of experiments in the Living Interfaces project, one part project is a door lock stalled at the inside of a domestic front door, and it remains locked until given a kiss by its owner [8]. There are various researches attend to invoke interaction metaphorically to disambiguate the users’ interpretation of how to interact with the objects.

**Fig. 2.1** Natural ways to manipulate light



## 2.2 Tangible Light

We first imagined Tangible light during a design exercise. In the design process we challenged ourselves to create interfaces with metaphor interaction by human senses without relying on abstract buttons or blinking lights.

### 2.2.1 Motivation

The idea of Cornfield Light comes from our memory that when we come through the cornfield we will stroke the waves of wheat and let it follow our footsteps (Fig. 2.1).

By brainstorming alternative ways of engaging the user on a physical, physiological and mental level, we decided to use behavior like gesticulation and action like waving as a metaphor affordance for light use.

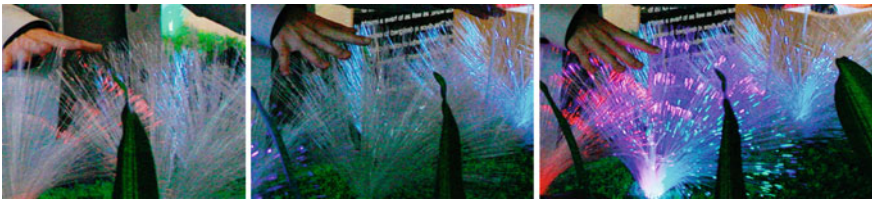
### 2.2.2 Interactive Design

Through this live Cornfield Light, we also try to put forward the prototype to quest for an innovative interaction design based on human behavior. In this prototype, there is a connection between human and product by making good use of the behavior. This kind of behavior comes from life experience and emotional experience of people. When people come through the cornfield they will naturally let hands on the sea of wheat and let hands waves metrically. In order to keep this kind of emotional interaction between product use and human being we explore to control a light in the same way. After doing research and talking about the aesthetics of the light, the shape of the light was designed like wheat (Fig. 2.2).

When using it, people come across to this kind of light; they will wave or touch the light naturally. At the same time, the light will turn on (Fig. 2.3).



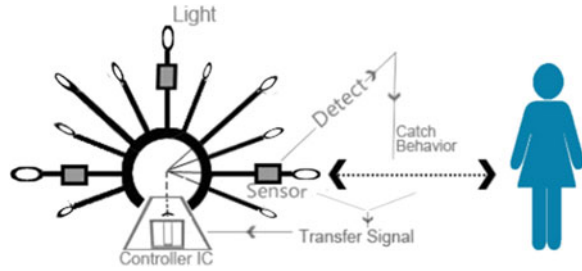
**Fig. 2.2** Cornfield Light, during experiment we design many lights in a platform to do exploration



**Fig. 2.3** Natural ways to manipulate light

Meanwhile in the real world, when a process that was not a focus of attention catches our interest, we are often able to seamlessly integrate it into our activity [9]. As natural behavior is a naturally element attracted by periphery sense user will subconsciously touching when use it.

Moreover during this process one thing we focus on to make the control system invisible. Mark Weiser's seminal paper on Ubiquitous mentioned: "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it".

**Fig. 2.4** System prototype

### 2.2.3 Implementation

The basic principle of this prototype is using the sensor to control the light's change situation. Every fluorescent light is made by a bunch of fiber which is like the plant. A color LED light is fixed at the bottom of the every fiber, and there're several sensors set both on the head and at the bottom of fibers, which are able to detect user's movement and position. Whenever people walk into it, touching the fiber, lights will be triggered, and they seem to be alive, being able to give feedback by a variety of changes according to people's location and movement, so that the interaction becomes more interesting and special (Fig. 2.4).

## 2.3 Tangible Light Study

We have set up the four Tangible lights beside a sofa of a drawing room for three consecutive days. Then we invited subjects for test, after that each of them did a questionnaire and all the process recorded by photos.

20 designers and 20 work staff participated in our experiment, including ten females and ten males, respectively. The 20 designers are people who work at design companies or teachers in design school. The 20 work staff is people who work in companies which have no relationship with design.

The data from the experiment is analyzed by appropriate methods then made a summary including key points from data of pictures and questionnaire (Tables 2.1 and 2.2).

Comparison the study, solutions that used metaphor tended to be more easily understood. Perhaps, this is because metaphors help the user apply analogies of structure and organization to the device, so the designer does not need to further specify the operation [1].

**Table 2.1** Key summary from video data

Designers	Work staff
Day 1	100 % subjects come across to the light and waved on the light 60 % subject interacts with the light several times Subjects felt surprise, pictures showed they all enjoyed that moment they turn on/off the light by their own natural way
Day 2	All the subjects' wave on the light naturally. 40 % subjects interact with the light when they felt tired
Day 3	All the subjects wave on the light naturally. 50 % subjects interact with the light when they felt tired

**Table 2.2** Key summary from questionnaire

Designers	Work staff
All the subjects said the device enlightened them when they did a natural gesticulation means turn on the light	
All the subjects believed it is a natural behavior to turn on/off the light	
All the subjects said the process they did to turn on/off the light is fitted for their emotion that their subconscious thinking	
50 % subjects believed this relaxed use experience let them felt confident	60 % subjects believed this relaxed use experience let them felt confident
60 % subjects were interested in this light system	50 % subjects so eager to have it that ask the price

2.4 Future Work

For further study we want to set this light in a gallery, and try to record the using experience by both artists and commercial people who have visited the gallery.

After this, a long-term study is planned. We decide to set three lights in three lights in three different places, in order to test the use experience by potential customers.

2.5 Conclusion

In this paper we add a new angle to design interaction and presented a novel interaction in which we find a natural connection between human and the device. From our testing we found that users enjoyed live natural lights. This explores guides the imagination beyond the constraints of function driven designs, and focuses on the higher level interaction design purpose and metaphors.

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