Design for Social Emotional Interaction in China: Light-Tech Driven Design and Prototyping Applied in Design Education and Research

Feng Xian and Zhiyong Fu

Dept. of Information Art & Design, Academy of Arts & Design,
Tsinghua University, Beijing, 100084 P.R. China
{xianfeng,fuzhiyong}@tsinghua.edu.cn

Abstract. Nowadays China is undergoing a development at top speed. The consumption capacity and acceptance to social service products are expanding every year. Especially, the social innovation and service design products based on light-tech and low-cost are very well received. As a very old oriental nation, Chinese have typical characteristics such as implicative, indirect, etc. As well as young people in China who were impacted by western culture in recent decades very like contracted and fashionable design. These provide very good keywords and references for social emotional interaction design in China. This article aimed at Chinese style emotional and interpersonal communication traits to discuss the concept of social emotional interaction design in Chinese design education and research, and advance a method of light-tech driven prototyping used to realize social emotional interaction prototypes. At the end of the article we gave some cases to show our researches and practices in our lab and courses.

Keywords: social emotional interaction, light-tech driven prototyping.

1 Background

With the development of social activities and information technologies, the needs of social interactive products increase progressively in all over the world. In China, more and more products are designed for intelligent life space, social network service, e-learning and digital entertainment, and hence the design research institutes regard social interactive products design as one of their most important education target. On the other side, some information technologies such as the internet of things (IOT), cloud computing, artificial intelligence, augmented reality, etc. will be integrated into social interactive products more often than before. So how to well apply and integrate these techniques in our lab and course practices to aid social interactive products' design is also becoming a very critical topic.

In this article we propose two concepts: social emotional interaction design and light-tech driven design and prototyping. The former is a subclass of social interactive design. It's also the main target in our past two years' research and teaching. The latter is a set of technical solution we applied in our lab research and course teaching.

On the design layer, we emphasize sociality, culturality, emotionality, and artistry factors for the social emotional interaction. On the technique layer, the light-tech resolution is proved to be able to comply with the circumstances of lab research and educational purpose and the trend of future social emotional interaction design.

2 Social Emotional Interaction Design

2.1 Concept

The concept of social emotional interaction (SEI) design is derived from three domains of research:

Social Emotional Development (socio-emotional development). This is original a research domain in psychology. Socio-emotional Development covers changes in a person's emotions, relations with others, self-concept, and personality, which is a stable way of thinking, feeling, and behaving. We each have an image of 'who we are,' our self-concept, or identity. It is made up of many different parts, things like ethnicity, intelligence, skills, family, and socioeconomic status. Descriptors that come after the phrase 'I am…' refer to your self-concept. Thus, it is an overall description of your abilities, traits, and personality. It is the type of person who you believe you are, which may differ from the type of person who you want to be. As you develop, your identity is constantly being modified by experiences and thoughts [1].

Co-experience. Co-experience focuses on how people make distinctions and meanings, carry on conversations, share stories and do things together. Understanding these interactions can make opportunities for co-experience designed into interactions of products and services.

Focusing on the design process, Hugh Dubberly and Shelley Evenson have proposed a five-cycled framework for creating the experience: (1) connecting, the initial connection which makes effective and affective impressions; (2) becoming oriented, the overview or preview of things available, allowing exploration and supporting learning in the early stage; (3) interacting with the product, the completed activities to obtain direct experiences, including such as establishing expectations, acquiring and using skills, delighting the senses, etc.; (4) extending perception or skill and use, the persons' expectations and experiences are raising continually and finally they become masters along with being more and more familiar to the product, a significant loyalty relationship between users and products achieved at the same time; (5) telling others or advocating, the person actively teaches the usage of the product and communicates their satisfaction to others [2].

The other framework of co-experience was also advanced by Jodi Forlizzi and Katja Battarbee. They deem that experiences with products will take on social dimensions and meanings when user experiences involve social interaction together. Experiences become a part of social interaction, and then meanings of individual experiences emerge and change. When something happened or something new is actively creating in period of product using, co-experience can be a measurement to evaluate social interaction. Storytelling, reinterpreting and recalling are all able to create co-experiences. People can find new meaning when they use a product together and

experiment new modes and technologies used in interaction. Jodi Forlizzi and Katja Battarbee have proposed three methods to create co-experience also: Lifting up experiences, Reciprocating experiences and Rejecting and ignoring experiences [3] [4].

Social and Emotional Interface. There is a panel in CHI 2002 which theme is Future interfaces: social and emotional. This panel addresses 'science fact' for future social-emotional interfaces. They discuss new theory and upcoming interface technologies that enable or augment social-emotional interaction between people and computers, and between people via new forms of computers. The theme is rooted in: (1) findings that human-computer interaction is social and emotional even when interfaces are not designed with such interaction as a goal, and (2) advances in technology, enabling computers to recognize, express, and respond to emotional and social information [5].

Today, the social communication mode of human being is evidently changed by the development of information technologies. More and More communication activities are via computer and networks, instead of the traditional face to face communication mode. The gap of physical space is never a problem for communicating information from one person to another person, but it still results in difficult to precisely and effectively express our emotions, experiences, feelings and status from us to others. The social emotional interaction (SEI) design is a kind of design in which tries to resolve this problem. We deem there should be three key factors must be stressed and included in the SEI design:

Human-Product Interaction. A product designed for social emotional communication should resolve a problem of interpersonal communication, as well as provide good human-product interaction and emotional experiences to users.

Interpersonal Communication. The SEI design should be an interactive design for multi-users. It is not a sort of simple human computer interaction. Actually it should be a kind of indirect human to human interaction. The computer and network are just intermedia.

Localization and Contextualization. The SEI design should be a user-centered design. It should be suitable for local culture, geography and technical competence and meet the requirements of usage, emotion and socialization for local people.

2.2   Users in China

Interpersonal Communication Features. China has long history and unique culture with a vast territory and enormous population. Chinese people have their own characteristic features on the aspect of interpersonal communication such as liking jollification, strong group psychology, preferring to take part in associations, strong regional thinking, etc. Therefore we should pay more attention to analyze Chinese users' psychology, conduct the differentiation design according to users' different hobbies and regions they live.

Emotional Features. The emotional features of Chinese people are implicative and connotative as a whole. But there are still obviously different between young people and elderly people. For young people, they are more individualized and fond of

chasing fashionable and cutting-edge things. Their visions of love are more open than elderly people. For elderly people, they usually regard family love very highly and deem that everything should obey certain rules. So our social emotional design products should also pay attention to people's different emotional features in order to win a place in the business market.

Consumption Features. Chinese people have the virtues of thrift. They stress importance of saving money. But many young people often consume excessively and result in overdraft also. On the other side, the elderly people generally have conservative thinking for spending money.

3   Light-Tech Driven Prototyping

3.1   Concept

Based on features above, we propose a concept of light-tech driven prototyping (LDP) to create SEI products for Chinese people.

The original definition of "low-tech" refers to traditional manual technology before the Industry Revolution. In recent years it is used in the field of architecture design that means simple and easy design. Low-tech design stresses that we should maximize the usage of natural resources locally. Here is the other concept so called "light-tech" extended from "low-tech". Light-tech emphasizes that we not only should simply use of recyclable architecture materials, but also manage to design for applying these resources most efficiently [6]. Nowadays we are in the era of information, the concepts of low-tech and light-tech can also be applied to design innovative social interactive products. In such kinds of design, we use appropriate manual technology combined with mature electronic technique and information technology to create low power consumption, low-cost and sustainable SEI products.

3.2   Principles

Some principles should be obeyed in LDP and LDP based products:

Low Power Consumption. LDP should be low power consumption. The products based on LDP should work well in power grid for civil use. Microprocessor Control Unit (MCU) is usually the core of a LDP based product. For example, the ATmega48PA/88PA/168PA/328P series of MCU used in Arduino, which is a very popular open-source interactive hardware platform, accord with the concept of low power consumption. At 1MHz, 1.8V, and 25℃, the specification of ATmega series is as follows:

– Active Mode: 0.2 mA
– Power-down Mode: 0.1 μA
– Power-save Mode: 0.75 μA (Including 32 kHz RTC) [7]

Low Cost. The proceeding of LDP should obtain raw materials locally as many as possible. Use manual technology and light machining to finish the whole processing of production in order to save the cost of products.

Sustainable. The LDP should guarantee the product available and work well as long as possible and can be upgraded by simply replacing modules or components.

Environmental Protection and Obtain Raw Material Locally. The LDP should guarantee the product meets the requirements of environmental protection, reduces the output of harmful waste or gas, and save as many cost of production and transportation as possible.

4   Research and Education Framework

The integration of SEI and LDP concept is a set of unique design thinking and methods in interaction design. The SEI relevant theories are the basis of design, and the LDP relevant techniques are the methods to achieve the goal of design. The figure below shows the basic relationship between SEI and LDP.
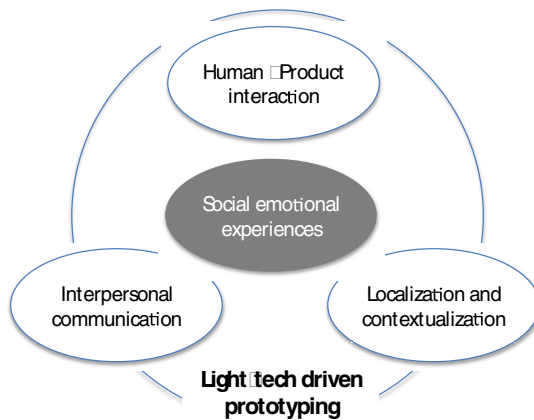

Fig. 1. Relationship between SEI and LDP

There are some divisions used to establish a design theme in our lab research and course teaching. One is interaction scale division which divided into three parts: room sized, body sized and hand sized [8]. The second one is interaction intention division such as for passing emotion, for expressing emotion or for communicating emotion. The third one is interaction expression ways division such as none-lingual expression, cross-cultural expression, contextualized expression or socialized expression, etc.

In our lab research and course teaching, we usually comply with following design steps to form an iterative work flow.

Prophase Survey and Concept Design. In the phase of prophase survey and concept design, we mainly use target user analysis, questionnaire investigation, field research and brainstorming to put forward some basic design targets. Some cases show this phase as follows.

Contextualization and Storytelling. Aim at these design targets, we attempt to simulate the real usage circumstances of the product, observe user behaviors in simulated environment and record the outputs. Via comparison of different outputs, we finally confirm specific usage context and interaction patterns. Some cases show this phase below.

Interaction Design and Configuration Design. With detailed usage context and interaction patterns, we will refine the interaction design for the product; make product diagram and structural drawing; define the technical specification and components the product should include.

Quick Prototyping. According to the technical specification and product drawing, we make a prototype of the product for following usability evaluation. In our experiences, LDP concept is quite fit for realizing quick prototype for small-scale, low-cost SEI products. It also very applies to educational and research purpose in design departments, institutes, colleges in university.

Usability Evaluation. In the last phase, we use prototype to evaluate user behaviors, record users' feedbacks and analyze outputs. The whole processing of SEI design and prototyping is iterative. The result obtained from usability evaluation should be used to improve product design and enhance the capacity of the product.

5   Case Study

This section shows some products' prototypes combined with concepts of SEI and LDP. Those prototypes are designed in our undergraduate courses and conducted by our teachers, lab assistants and students. For undergraduate level design and practice, students are emphasized to conduct the SEI design concept and use LDP based practice methods to construct (or integrate) creative product prototypes. Some specific technologies and methods we recommend include: (1) physical computing technology, a typical light-tech which is very suitable to realize simple hand, body and room sized interaction products, (2) behavior analysis and usability evaluation methods to target users such as between user, within user and mixed user tests, and (3) contextual storytelling for quick prototyping, etc.

Some of final outputs of our course are very close to real form of products, whereas others are more conceptual and not enough robust in technical level. But all of them are good combinations of SEI design concept and LDP practice methods.

5.1   'Emotional Lamp'

Emotional lamp is a kind of intelligent appliance or exhibition installation for passing the current state of us to others. It is also able to detect remotely if there are somebody in certain space or not. Emotional lamp uses camera sensor and visual recognition technology to detect people (e.g. people's emotional expression, or color and pattern of peoples' clothes) and transmit signals via embedded MCU modules or IPV6 network directly to local devices or the far-end (a common server or cloud computing based server). The receiver controlled by an Arduino based module in local or in remote will turn on devices (e.g. lamp, siren, screen, etc.) when signals received.

Specifics of Emotional lamp design:

– *Interaction scale: room sized*
– *Interaction intention: expressing emotion and communicate emotion*
– *Interaction expression ways: none-lingual, contextualized and socialized*

Fig. 2. Prototype I: Intelligent appliance with camera embedded inside (detect facial expression)
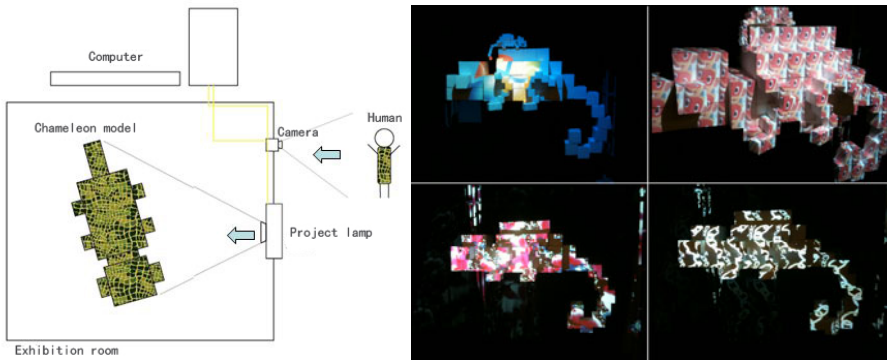

Fig. 3. Prototype II: Exhibition installation in public space (detect color and pattern of clothes)

5.2   Interactive Toy Design for Kids' Social Emotional Development

Following is a set of toy design prototype. The main structure of the toy is made by handiwork. A micro RFID module is embedded into it as the sensor and reader. When children put different cards or models on the game board, the computer, which connected to the game zone, will receive the id of them. According to the id, the computer will play different interactive content to users. This toy is benefit for kids' social emotional development when many kids play together or play with parents.

   Specifics of Interactive toy design:

– *Interaction scale: body sized*
– *Interaction intention: passing emotion and communicate emotion*
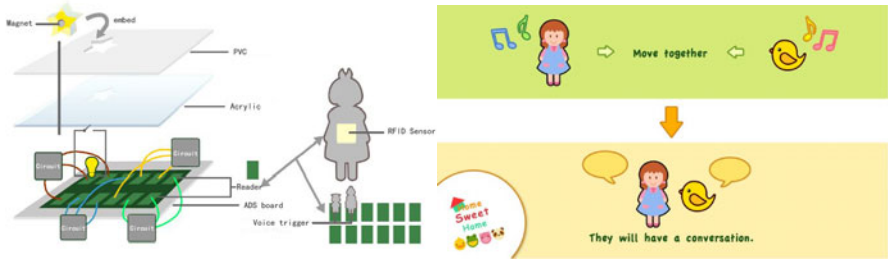– *Interaction expression ways: contextualized and socialized*

Fig. 4. Schematic diagram of interactive toy

Fig. 5. Prototype of interactive toy

5.3   Vocal Glove for Deaf and Old People

This is a conceptual design product. We conceive that embeds a module with curvature sensors and a vocal component into the common glove to realize the simple communication between deaf or old people and common people. We assume signals detected from curvature sensor can be mapped to the gesture language one by one, and the gesture language is mapped to voices stored in the vocal component, so that the deaf or elderly people can only make gestures and then the glove will play corresponding voices to the common people.
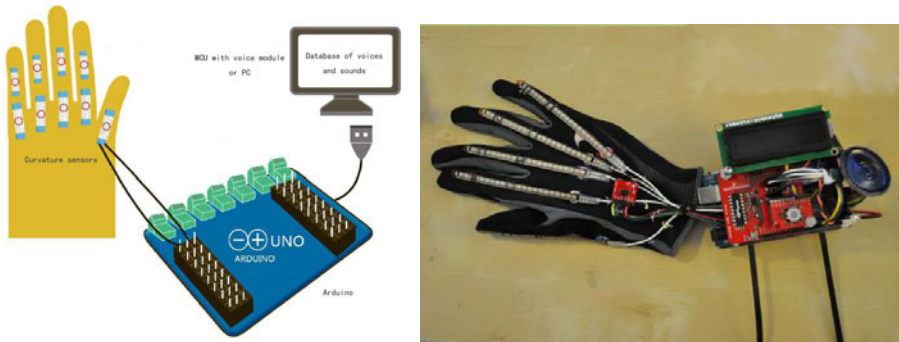

Fig. 6. Schematic diagram and prototype of vocal glove

Specifics of Vocal glove design:

– *Interaction scale: hand sized*
– *Interaction intention: passing emotion and communicate emotion*
– *Interaction expression ways: cross-cultural, contextualized and socialized*

6   Conclusion

Although we consider that the integration of SEI and LDP is an effective approach to design social interaction products, but the prototypes built by LDP based methods are only the threshold of real SEI products after all. How to guarantee these prototypes can be extended to real products? We reckon it lies on two aspects at least: (1) more objective analysis of user experiences and behaviors can make us avoid creating impractical SEI design, (2) LDP concept is advocating 'light-tech neither only for saving costs, nor for refusing high-tech solutions. Using appropriate techniques to realize our design is forever better than blindly chasing costs-saving or high-tech.

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