DESIGNING A SMART WORKPLACE TO ASSIST DESIGN ACTIVITY FROM AN EMOTIONAL APPROACH

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Abstract. In this paper, we are interested in developing a smart workplace to assist design activities during design processes from an emotional approach. A key problem in this study is how to design a smart environment, which is able to detect the designer's emotional state and provides smart mechanism to assist design work. In the preliminary study, a spatial system prototype is developed to illustrate the design ideas of the smart workplace. Some triggered spatial events to describe the capabilities of assisting design activities from an emotional approach is introduced in the study. The framework of ubiquitous computing design in developing the smart workplace is introduced.

Keywords. Smart Space, Emotional Design, Ubiquitous Computing.

1 Introduction

Researches in smart space design focused on how to detect human needs in a space and provide appropriate responses wisely. Based on the developments of ubiquitous computing technologies, many researchers studied issues regarding with developing a programmable space in accordance with various design goals (Jeng, 2005). On another hand, a designer's emotion has been indicated as an important factor to do creative work based on the researches in emotional design (Klein et al., 2002; Norman, 2004; Mignonneau and Sommerer, 2005). A typical emotional state of a designer changes the way to think, serves as the guide to behave himself, and steers him away from the bad. A positive emotion may guide a designer to do creative work. A negative emotion, on the other hand, may lead a designer to produce bad design results. In this study, we are exploring issues in designing a smart workplace to assist design activities from an emotional approach.

2 Literature review

Work design is defined as designing work environment (Kishimoto, Naka et al., 2007). The work design contains four aims: including interaction, visualization, inspiration trigger, and

tracking. Becker and Steele indicate there are three key elements related with work decisions, including work processes, information technology, and physical settings (Becker and Steele, 1994).

Goleman indicates emotion is a feeling and distinctive thought, which reveals the psychological state, biological state, and the behavioral propensity of a person (Goleman, 1995). Although there are many more subtleties of emotion than we have words for, however, Goleman classified emotions into eight families and argued that all the emotions should belong to one of these families. These families of emotions are: anger, sadness, fear, enjoyment, love, surprise, disgust, and shame. In turn, our emotions change the way we think, serve as constant guides to appropriate behavior, steers us away from the bad, and guides us toward the good. Human being is emotional and emotions thus influence our everyday behavior and as a consequence emotions affect our work (Martinez-Miranda and Aldea, 2004).

Based on the literature reviews, we can see the emotions influence the behavior of a typical designer during design processes. Of course, there are various types of human emotions. Some emotions appear positive to assist design work. On the other hand, some emotions seem negative, which may affect designers to do unusual work or even lead to bad design results. Of course, sometimes, a negative emotion, such as anxiety, may also push a designer to work with effectiveness. These literature reviews form the foundations to explore the research issues in the study.

3 The Research Scope

In this study, we are interested in how to assist design activity from an emotional approach in developing a smart workplace project. The key problems are how to detect the designer's emotional state and how to response wisely to assist design activity by applying ubiquitous computing technologies. The research scopes then include:

- How to analyze and classify the emotional state of a designer?
- How to detect the emotional state of a designer in a workplace?
- For each emotional pattern detected, what kind of smart mechanism should be provided to support design activity?

4 The Implementation

To achieve the research intention, the study first conducted design experiments to analyze the types of emotions of a typical designer. Our approach is to augment ubiquitous computing devices into a designer's workplace. We monitor and record the design activities of a typical designer during the design processes. Based on the recorded data, an intensive survey to the designer followed to discover the emotional patterns during the design processes. These discovered patterns are analyzed and classified based on Goleman's research mentioned previously. These patterns are further used to implement the smart mechanism in developing the smart workplace to assist design activities during design processes. The important steps to develop the smart workplace project are described as below.

4.1 ANALYZING EMOTIONAL PATTERNS

In order to discover the emotional types of designers, the study started to interview with visual communication designers with professional work experiences. The study also conducted a serial of design experiments to collect the data regarding with designers' emotions during the design process, Figure 1.

Figure 1. Design experiments for a typical visual communication designer

According to the collected data, a set of emotional patterns of facial expressions, including happy, sad, angry, anxious and relaxed, are labeled based on a common sense survey to a typical designer, Figure 2. These emotional patterns are further divided into positive and negative two parts. The positive emotional patterns include happy, relaxed and anxious. The negative emotional patterns include sad and angry.

Figure 2. A set of emotional patterns of facial expressions

4.2 ALGORITHM FOR EMOTIONAL PATTERN RECOGNITION

The wavelet coefficient mapping is used as the algorithm to detect the designer's face for emotional pattern recognition in the study. The process of wavelet coefficient mapping is shown as Figure 3. Instead of colourful picture, we use greyscale picture to analyse and recognize the emotional patterns, which is more effective based on Kuo and Chen's research (Kuo and Chen, 2003). Besides, Tsao also indicates that the greyscale picture can reduce the mistakes of detecting patterns (Tsao, 2005).

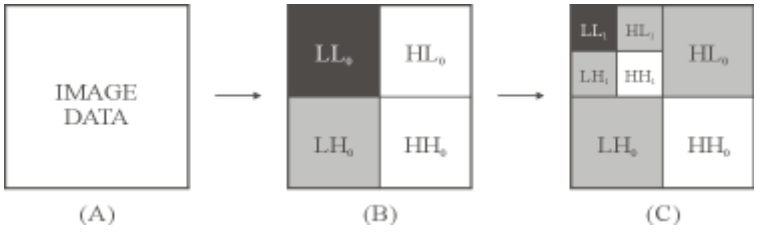

Figure 3. The process of wavelet coefficient mapping

Based on the wavelet coefficient mapping, the study developed a smart mechanism to detect the emotional pattern of a facial expression of a typical designer. With the smart mechanism, once a webcam detects a typical emotional pattern, the developed system will trigger a corresponding spatial event to improve or enhance the emotional state of a typical designer to support his design activities. This smart mechanism provides the positive assistance to the designer from an emotional approach based on our assumptions described below.

4.3 SPATIAL EVENTS TO ASSIST DESIGN ACTIVITY

In order to explore the research intention of assisting design activity from an emotional approach, there are two assumptions to establish the research foundation in the study. The first assumption is designers can be more creative while they are at positive emotional states in a personal workplace. The second assumption is a negative emotional state of a designer should be improved in order to support positive design activity via a proper spatial event.

Based on the two assumptions, the study starts to explore how to response a typical emotional pattern of a designer appropriately by a corresponding spatial event. A set of spatial event scripts corresponding with various emotional patterns of a typical designer then are set up to support the needs of the designer from a human-sense approach. At current stage, the human senses of sight, hearing and smell are explored to support the capabilities of improving the emotional state of a designer by a typical spatial event. Two spatial events corresponding with positive and negative emotional state to assist design activity are briefly described as follows.

For instance, once the designer is detected at a positive emotional state, such as relaxed, that means the designer desires to see some beautiful environmental scenery, to hear some joyful music and to smell some nice fragrance. The corresponding spatial events then are triggered to support the needs of the designer. On another hand, when a designer is detected at a negative emotional state, such as sad, based on the triggered spatial event, the system will try to comfort him by showing some proper message, giving him some advices to take a rest, or playing some comfortable music, to improve the bad emotional state. The notion of assisting design activities during design processes from an emotional approach is shown as Figure 4.

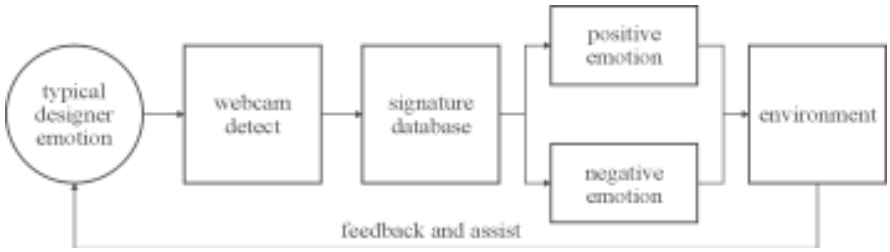

Figure 4. The notion of assisting design activities during design processes

4.4 SYSTEM PROTOTYPE

To verify the research intention, the study develops a spatial system prototype to assist design creativity based on ubiquitous computing technologies. A set of web cameras, sensors and flat displays are augmented with spatial components in the personal workplace. The system framework is shown in Figure 5. These ubiquitous computing devices are used to detect the emotional state of a designer and provide appropriate support in assisting design activities. Once a typical emotional state is detected, it will trigger a spatial event programmed in the system, and the spatial components will turn to a new state in accordance with the triggered event.

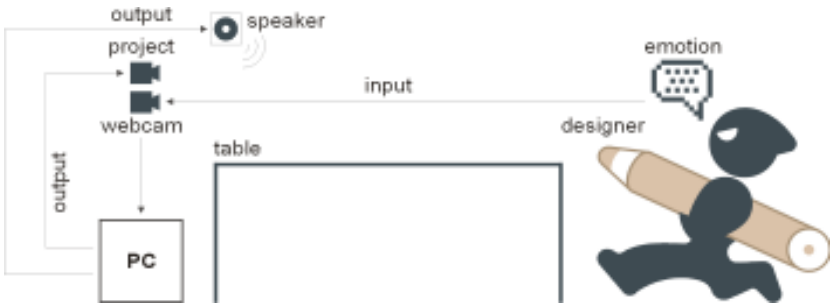

Figure 5. The system framework of the spatial system prototype

The developed spatial system prototype of the designer's workplace is shown as Figure 6. The notebook with a webcam embedded is the main tool to do design work for the designer. One tablet PC and one video projector are augmented with the vertical partitions in the personal workplace to display the spatial information triggered for user interaction. Two speakers are installed at top sides of front panel to play music. A bottle of perfume to diffuse the fragrance is put on the table for manually access.

Figure 6. The spatial system prototype

5 Summary

The research adopts an emotional approach to develop a smart workplace in assisting design activities during design processes. In this pilot study, the overall research scopes are explored. The emotional patterns of a typical designer are analyzed and labeled for pattern recognition. These emotional patterns can be detected by the developed mechanism. Besides, based on some assumptions, for each emotional pattern detected, a corresponding spatial event will be triggered to assist design activity during design process. A spatial system prototype with overall framework of personal workplace is developed to verify the research intention.

For further studies, the spatial system prototype need to do more rigorous evaluation tests since it is developed based on some subjective assumptions. The system prototype can only show the preliminary achievements of overall research scopes. Besides, based on our observations, the spatial system prototype could successfully detect the emotional state of a typical designer and trigger corresponding spatial event. However, the designer shows low satisfaction to the system performance from various points of views. Therefore, a more complete understanding of the empirical study to support the design work from an emotional approach is still need to be studied further in the future.

Acknowledgements

This study is partial supported by National Science Council in Taiwan, NSC96-2221-E-025-012. The authors are grateful to this support.

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