Augmenting Emotional Interaction Through Physical Movement

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ABSTRACT
This paper describes Emotion Palpus, a new interactive media for emotionally rich interaction between human and product. It augments emotional experience by using physical movement as an element of interaction. It can be attached to existing products like a PC display or a telephone. We developed an interactive display monitor equipped with Emotion Palpus as an example application. It can express the computer's status information emotionally. The hardware looks like a palpus of insects and the software consists of two parts; one is for authoring movement and building a movement database, the other is for controlling emotional movement and connecting them with the database. This research shows the possibility of the application of physical movement as a new media to express emotions.

ACM Classification: H5.m [Miscellaneous]

General terms: Design

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INTRODUCTION
As interactive products permeate more closely in everyday life, providing emotionally rich interaction is becoming more important. Sharing and interlocking mutual expression of emotion can highly enrich interaction. People express emotion through facial expressions, tone of voice, and behavior. In human-product interaction, however there is a lack of means for emotional expression besides sound and screen display.

Physical movement is worthy of note as an alternative media for a product's emotional expression. In graphic design, kinetic typography supports more emotional communication through dynamic movements than static typos. The dynamic blinking of LEDs in digital appliances and the graphical equalizer of audio systems are examples showing emotional expression of products. With the physical movement of a cuckoo clock or a pendulum of wall clock, people have different emotional feeling to the products. Thanks tail [4] and Nabaztag [5] are examples showing the possibility of applying physical movement to actual product.

We aimed in this research to consider the details of applying physical movement, finding ways to obtain maximum interaction effects from minimum elements, and presenting its case study.

In the present research we propose a new media which uses physical movement for supporting and augmenting emotional interaction.

THE APPLICATION OF PHYSICAL MOVEMENT
In order to develop an emotional interaction by the application of physical movement, it is necessary to investigate a framework of the relationship between physical movement and emotion. A number of previous studies identified this. For example, Pollick et al. suggested that greater activation is related to greater magnitudes of movement speed [1]. Boone and Cunningham explained greater activation has greater openness of the movement while greater pleasant feeling is related to greater smoothness of movement [2]. On the other hand, from interviews with dance producers, we found that movement and its emotional message can vary according to the context.

Based on the review of previous researches and the field study, we developed the framework for the relationship between emotion and movement as shown in figure 1.

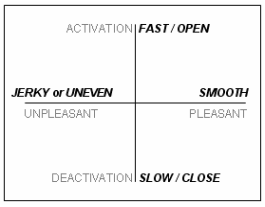

Figure 1: The relationship between emotion and movement.

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Three movement qualities are defined to express emotions: speed, openness and smoothness.

Concept of Emotion Palpus

Emotion Palpus is a physical component that can express various emotions through movement. The metaphor is from a palpus of insects expressing emotions through moving feelers. It can be attached to existing products, such as PC monitors, telephones, and audio devices. Emotion Palpus has a bar-shaped structure which consists of several pivot joints (Figure 2). It can express various movements while minimizing structural restrictions. It can provide a more emotionally rich interaction by utilizing pairs.

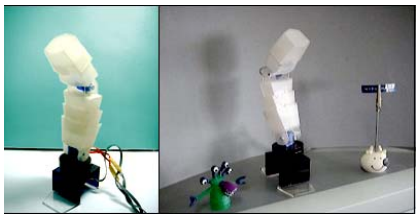

Figure 2: Picture of developed emotion palpus and using with computer monitor.

Example Applications on a PC Monitor

We developed an interactive display monitor equipped with Emotion Palpus as an example application. Connected with the PC, Emotion Palpus can express the computer's status information emotionally. For example, information on how busy the computer is, how many windows are open, how long the PC has been turned on, is expressed by the emotional movements. When a PC user plays music, it dances along according to the rhythm of the music. When the PC is infected by a virus, an alerting movement is expressed. Examples of emotional expressions are shown in Table 1. The computer's status information is transformed to emotion and the assigned movement is generated by the framework.

Status	emotion	movement
Normal	Serene	Turn to right and left regularly…
Busy	Nervous	Wide Opening and fast jerky…
Idle	Lonely	Bending inside with slow nodding

Table 1: examples of applied movements

In other possible applications, Emotional feeling can be indirectly delivered by telephones equipped with Emotion Palpus. A music system can express various moods. Emotion Palpus can express its mood with physical movement.

Configuration of Emotion Palpus

The Emotion Palpus system consists of two parts; one is for authoring movement and building a movement database, the other is for controlling emotional movements and connecting them with the database.

The hardware part consists of a lower part which rotates horizontally and two elbow joints (Figure 2). This hardware was implemented with three servo-motors connected to the PC with one Phidgets' Interface Board. The software controlling the servo motors was implemented with Macromedia Director MX and MIDAS toolkit [3]. The software has the user interface for authoring movement for corresponding emotions, and for building the database. Users can define various emotions by changing speed, acceleration, angles of the hardware's movement. Users also need to assign the computer's status with the movement database. The framework can be used for the association. A software application was developed to get the status information of the PC and send it to the control part of Emotion Palpus. The infrastructure of hardware and software is shown in Figure 3.

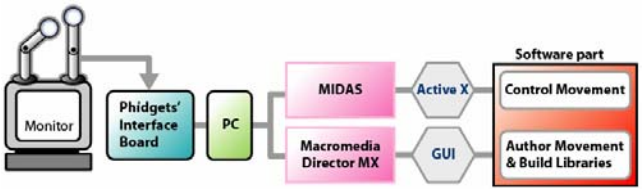

Figure 3: The infrastructure of hardware and software.

CONCLUSION AND FUTURE WORK

We present Emotion Palpus for supporting and augmenting emotional interaction between human and product. It uses physical movement as an element of interaction. Users of products with Emotion Palpus can have more emotionally rich experiences. This study shows the possibility of the application of physical movement as a new media that expresses emotions.

For future work, it is necessary to improve the structural aspect of Emotion Palpus for more diverse expression of emotion. User study is also required to evaluate the validity of the new media. The relationship between movement and emotion is to be investigated while the database is to be built. Applications are tested for other products such as mobile phones.

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