Mood Swings: An Affective Interactive Art System

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Abstract. The progress in the field of affective computing enables the realization of affective consumer products, affective games, and affective art. This paper describes the affective interactive art system Mood Swings, which interprets and visualizes affect expressed by a person. Mood Swings is founded on the integration of a framework for affective movements and a color model. This enables Mood Swings to recognize affective movement characteristics as expressed by a person and display a color that matches the expressed emotion. With that, a unique interactive system is introduced, which can be considered as art, a game, or a combination of both.

Keywords: Mood Swings, affect, colors, movement, interaction.

1 Introduction

Emotions play a major role in judging (the use of) products [1]; for example we can feel great using a product that is not user friendly, but pleasing to the eye. Hence, next to usability other factors also play a role in user experience. In 2007 Sony introduced a photo camera with a "smile shutter" that recognizes whether or not the person in focus is smiling [2]. The camera can detect smiles, but is it possible to detect happiness? In the field of affective computing, systems are being designed that can recognize, interpret, and process emotions [3,4]. Picard states that computers need the ability to (at least) recognize and express affect to achieve natural and intelligent interaction with humans [4]. Interest shifts from intelligent to sensitive products.

In (interactive) art affective technologies can also be applied. An example is The Empathic Painting by Shugrina, Betke, and Collomosse [5]. The painting assesses the emotional state of a person through facial expression recognition, and uses this information to adjust the painting's color use and type of brushstroke. In this way the audience can experience digital art in a novel way.

Expanding research on this topic is interesting in order to acquire more insights in affective computing in different contexts. Therefore Mood Swings, an interactive light installation, was created. The installation consists of eight luminous orbs that

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Fig. 1. Mood Swings' luminous orbs in action

react on movement and take on certain colors with distinct movements, creating patterns of light. In this way users are challenged to express their emotion. Figure 1 depicts a person interacting with Mood Swings.

2 Related Work

Besides The Emphatic Painting, another example of affective interactive art is The Expressive Control. This system allows users to use their full-body for controlling the real-time generation of expressive visual and audio feedback. The system extracts expressive motion features from the user's full-body movements and gestures, and uses these parameters to project visuals on a screen and play audio [7].

The interactive art system Iamascope uses a video camera lens as the eye of a kaleidoscope and projects a kaleidoscopic image of the user onto a large screen. The image is also accompanied by musical notes, which are dependent on the speed and frequency of the participant's movements [8]. Special about this artwork is that it was used for a user experience evaluation. Costello, Muller, Amitani, and Edmonds aimed to find a methodology for recording and analyzing the experience of interactive art [8]. In examining the interaction with Iamascope, they discovered "The Trajectory of Interaction": common phases in interacting with interactive art. They labeled these phases: response, control, contemplation, belonging, and disengagement. In the response phase, the participants try to discover how the system works. In the control phase, the participants try to manipulate the device. In the contemplation phase, the participant reflects upon the meaning communicated by the artwork. The belonging phase is reached when a participant feels controlled by the installation itself. The disengagement phase is the final phase in the trajectory and encompasses the patterns of behavior that take place when the participant decides to stop interacting.

Evaluating this kind of interactive systems is common in Human Computer Interaction (HCI), but it is not common to test the interaction in art. This is because HCI evaluation strives to be objective, while in art it is all about the subjective opinion of a single observer [9]. Mood Swings was also evaluated to investigate whether the same phases as discovered by Costello et al. could be identified.

3 Mood Swings' Foundations

3.1 Emotions Expressed in Movement

The relationship between emotion and movement had been studied in many different ways, e.g. by looking at specific movements of certain body parts, or by studying qualities of body movement (e.g., speed and fluidity of movement). Laban, a famous dancer and choreographer, studied these qualities and developed a system to describe movement called: effort and shape. His description of movement features (weight, time, flow, space, and path) is used as a starting point in many researches [10, 11, 12].

In general, affect can be labeled in two manners; in discrete or dimensional emotions. Discrete emotions describe the affective state using basic emotions (e.g., fear, joy, sadness). A widely accepted approach of classifying emotions in a dimensional fashion is described by Russell [6]. He developed a circumplex model of affect that describes emotions in the two dimensions: valence (pleasure-displeasure) and arousal. In research by Lee, Park, and Nam [13] this model is transformed to be applicable to affective movements. They applied certain movement characteristics to the circumplex model by Russel, which led to the affective dimensions: velocity and smoothness (the regularity of a movement). These dimensions also appear to have a relationship to the features time and flow as described by Laban.

In the design of Mood Swings the model by Lee et al. [13] was incorporated. Arousal is related to the velocity of a movement, with slow movements linked to low arousal and fast movements linked to high arousal. Valence is related to the smoothness of a movement, with smooth movements being pleasant and jerky movements being unpleasant. Users interact with Mood Swings through moving the orbs. The orb's movement patterns are registered through an accelerometer placed inside the orb. Consequently, the orb is used to derive users' emotions.

3.2 Visualizing Emotion in Color

Mood Swings' feedback exists of colored light. Color is chosen because of the strong relation it can have with emotion. There is a reason why we can feel blue, become red with anger, or green with envy. Meaning is given to color due to evolution, personal experience, and cultural factors [14]. Artists use color to provoke emotions in people.

eMoto, a mobile messaging service developed by Ståhl, Sundström, and Höök, uses sub-symbolic expressions for expressing emotions [11]. A user can adjust the background (i.e., colors, shapes, and animations) of a text message to fit the emotional expression s/he wants to achieve. Emotion was linked to color according to Ryberg's color theory (as cited in [11]). In this theory, the most powerful and strong emotions are represented by red, and emotions with less energy are represented by blue, the color at the other end of the color scale. Ståhl et al. applied Ryberg's color theory to Itten's circular color model [11,15], which in turn can be adjusted to fit Russell's circumplex model of affect, as is shown in Figure 2. The colors fade to white towards the circle's center since in that point valence and arousal are neutral.

Itten's transformed color circle, as used in [11] is applied in Mood Swings, using six colors in combination with the emotion-movement relation framework of [13]. Six colors are used because results from a user test that investigated the functioning of

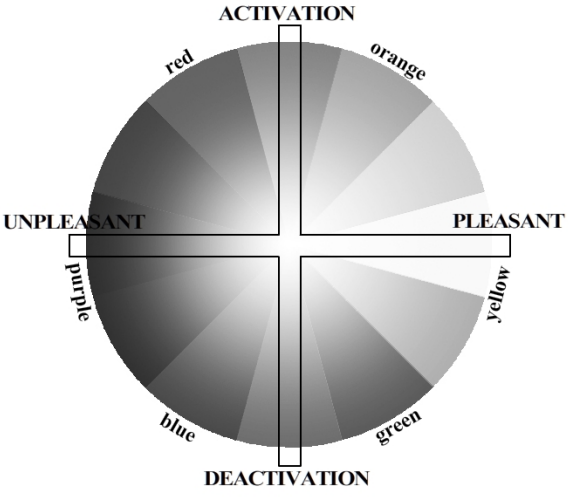

Fig. 2. Itten's color system [11,15] fitted to Russell's circumplex model of affect [6]

Mood Swings showed that using more colors made the installation's feedback harder to understand. The actual colors Mood Swings expresses are generated by six LEDs that are placed inside each orb. They react on the accelerometer inside the orb, hence displaying the color that reflects the emotional state of the user, based on the user's movements. The colors and their accompanying emotions are presented in Table 1. When Mood Swings is in rest, the orbs have a neutral/calm color, light mint green, to indicate to the audience the installation is on and the orbs have lights in them.

Table 1. Mood Swings interprets movements in terms of valence and arousal and subsequently provides feedback through colors. Mood Swings' translation of the dimensions of emotion to colors is denoted in this table.

Arousal	Valence	Color
High	Negative	Red
High	Positive	Orange
Neutral	Negative	Purple
Neutral	Positive	White
Low	Negative	Blue
Low	Positive	Green

3.3 User Test

Mood Swings was evaluated in a museum for contemporary art by 36 museum visitors. The preliminary results confirm The Trajectory of Interaction, although not all phases were reached. Few participants reached the contemplation phase, and none of the participants reached the belonging phase. A difference was found in the manner

of interaction in the disengagement phase. This phase is characterized by the fact that the participants repeat a previous action sequence that they performed during their most intense control state. Unlike [8], the preliminary results show that trying to discover new things can also take place during the disengagement phase.

When asking the participants how they would define Mood Swings, most of the participants indicated they saw it as either art or a game. Other definitions were: living creature, computer application, living room lighting, and as a communication device for a public space or waiting rooms. Many participants saw Mood Swings as an application for children, in school, on a playground, or in a therapy room.

4 Discussion

In research by Pasch, Berthouze, Van Dijk, and Nijholt [16] on physical activity as interaction mode in video game consoles, they state there is a link between physical activity and engagement. If a game technology is able to interpret the affective state of the gamer and adapt the game to steer the gamer's movements, this will lead to a more enjoyable interaction.

In the current system, all the orbs work individually. This means that the emotion expressed by the user is visible in each orb individually. An example, if a user wants to express anger, s/he will move quick and random. In doing so, not all orbs will be touched equally. Maybe some orbs will barely move and light up in a color appropriate for relaxation. A nicer solution would be to let the orbs be aware of each other. In this way, the installation can let the orbs cooperate (e.g., through calculating a mean) and adjust the feedback more appropriately. The installation would be more cohesive, and including other feedback modalities like audio would be easier. Another advantage is that it would be possible to create more suitable games for Mood Swings, which will lead to a more natural and richer experience as discussed by [16].

Mood Swings is founded on a theoretical framework to facilitate the recognition of emotions as expressed in movements and reflecting them by displaying corresponding colors. Mood Swings was evaluated to identify The Trajectory of Interaction. All of the trajectory's phases, except one, were observed. Hence, Mood Swings' working was confirmed and the generic use of The Trajectory of Interaction was illustrated.

Mood Swings was originally designed as an affective interactive art installation, with no function and as its goal to be fun. While observing people interacting with the system, it became clear that Mood Swings indeed has the qualities of an interactive art installation, but furthermore was used as a game and a communication device. By adding cooperating orbs and/or other feedback modalities, Mood Swings could be more effective and even more suitable as a game or communication device.

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