# Interactive Art for Zen: "Unconscious Flow"

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## Abstract

*In face-to-face communications, the occasional need for intentional lies is something with which everyone can identify. For example, when we get mad, circumstances may force us to put on a big smile instead of expressing our anger; when we feel miserable, good manners may dictate that we greet others warmly. In short, to abide by social norms, we may consciously lie. On the other hand, if we consider the signs that our bodies express as communications (body language), we can say that the body does not lie even when the mind does. Considering this phenomenon, we propose a means of "touching the heart" in a somewhat Japanese way by measuring the heartbeat of the "honest" b¡ody and using other technologies to develop a new code of non-verbal communications from a hidden dimension in society. We call this "Meditation art" or "Zen Art." "Zen" is Buddism style meditation.*

*Keywords: HCI (Human-Computer Interface), Character Behavior, Mixed Reality, Real-time Animation, Interactive Art*

## 1. Introduction

The author believes that interactive art is one type of component that provides sympathy in communications. Interactive art can be thought of as an emotions and sympathy interface. It is familiar to us and forms agents or characters that can handle sensitive communications. In addition, such agents/characters work on our mental states and emotional expressions, and on our character and intelligence. This means that a person can also self-create his or her own personality. On the other hand, emotion recognition technology recognizes only the surface emotions of people [1][2][3].

The authors are interested in how to recognize unconscious feelings by using computer-based interaction (Figure.1). Art is a natural way to portray human unconscious emotions. We have been trying to achieve this in interactive art by using the technologies and techniques of art.

Figure 1. Mask of the human face

## 2. Concept of Unconscious Flow

Two computer-generated mermaids have been function as individual agents for two viewers. Each mermaid agent moves in sync with the heart rate detected by a BVP (blood volume pulse) sensor attached to a finger of its viewer. Then, using a synchronization interaction model that calculates the mutual heart rates on a personal computer, the two mermaids express the hidden non-verbal communications of the viewers. The relax-strain data calculated from the heart rates and the level of interest data calculated from the distance between the two viewers are mapped on the model. The synchronization interaction model reveals communication codes in hidden dimensions that do not appear in our superficial communications.

Then, using a camera to pick up hand gestures and a personal computer to analyze the images, the



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synchronization interaction model is applied to determine each mermaid's behaviors. For a high degree of synchronism, the agents mimic the hand gestures of their subjects, but for a low degree of synchronism, the agents run away. As for the background sound, the heart sounds of the subjects are picked up by heart rate sensors and processed for output on a personal computer for bio-feedback.

For the installation, a space of four meters wide, four meters deep and three meters high is required. A dark and quiet space is preferable. Interactive actions are displayed on one main screen and two Japanese "shoji" screens. A Japanese "hinoki" wooden bucket with a diameter of one meter that is filled with water is placed in the center of the installation. Two persons, each fitted with a stethoscope, experience non-verbal communications by touching their Computer Graphics embodiments in the bucket. This was shown at the SIGGRAPH'99 Art Show. People of many nationalities interacted with the [Unconscious Flow] (Figures 2-1. and 2-2).

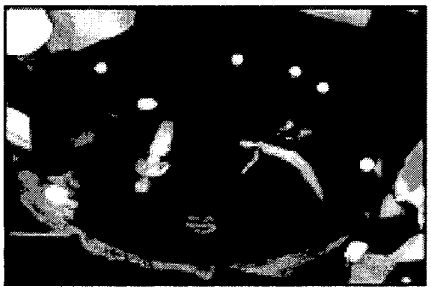

Figure 2-1. [Unconscious Flow] exhibited at the SIGGRAPH'99 Art Show

Figure 2-2. [Unconscious Flow] exhibited at the SIGGRAPH'99 Art Show

## 3. Synchronization Interaction Model

The relax-strain data calculated from the heart rates and the level of interest data calculated from the heart rate variations are mapped on the model. The synchronization interaction model reveals communication codes in hidden dimensions that do not appear in our superficial communications (Figure 3).

Depending on the levels of the users' feelings as evaluated by the interested/less interested and strained/ relaxed axes, the following four types of animations are generated.

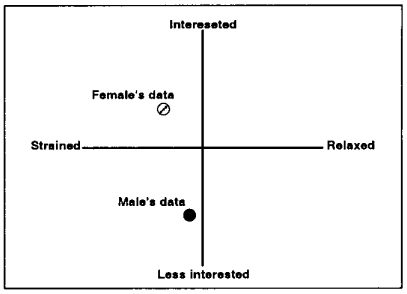


Figure 3. Synchronization interaction model

(1) When both people are in a situation where they are highly relaxed and interested, they are considered synchronized. An animation is generated in which, for example, their Computer Graphics-reactive embodiments join hands in companionship or enjoy friendly actions (Figures 4-1 and 4-2).

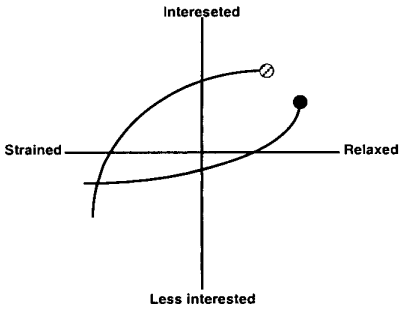


Figure 4-1. Highly relaxed and interested

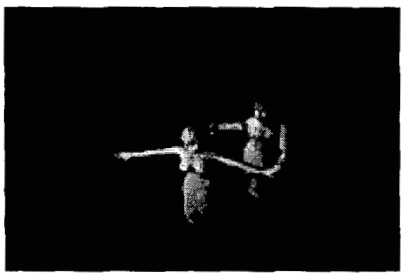

Figure 4-2. Highly relaxed and interested

(2) When both people are in a situation where they are highly strained and less interested, unfriendly communications is generated. An animation is generated in which, for example, their Computer Grahpics embodiments quarrel with each other (Figures 5-1 and 5-2).

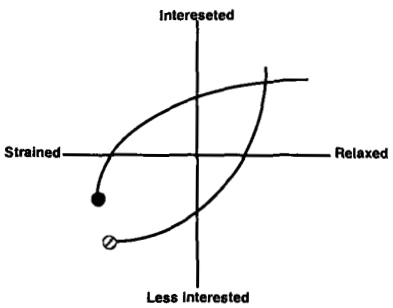


Figure 5-1. Highly strained and less interested

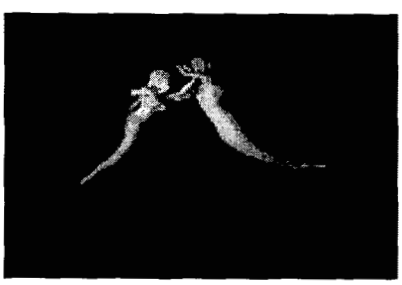

Figure 5-2. Highly strained and less interested

(3) When both people are in a situation where they are highly relaxed and less interested, they are considered indifferent and "going their own ways". An animation is generated in which, for example, their Computer Grahpics embodiments do not interfere with each other (Figures 6-1 and 6-2).

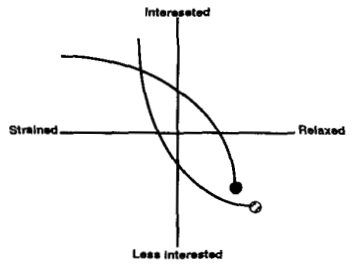


Figure 6-1. Highly relaxed and less interested

Figure 6-2. Highly relaxed and less interested

(4) When both people are in a situation where they are highly strained and highly interested, they are assumed to have stress and feelings of shyness. An animation is generated in which, for example, their Computer Graphics-reactive embodiments behave shyly, in the way shown below (Figures 7-1 and 7-2).

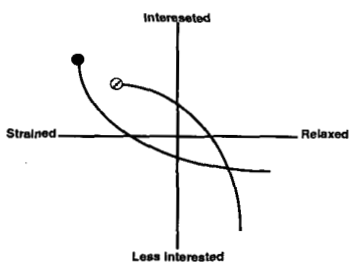


Figure 7-1. Highly strained and highly interested

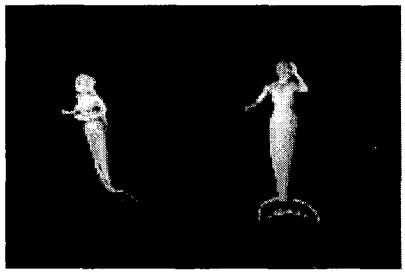

Figure 7-2. Highly strained and highly interested

As described above, new codes of non-verbal communications that cannot be seen in face-to-face communication are found through Computer Graphics embodiments.

## 4. System

### 4.1 Hardware

The synchronicity based on the heart rates from the electrodes of an electrocardiograph is calculated by a PC, and the PC generates an arbitrary feeling in Computer Graphics form. The hand movements of the two persons are captured by an installed camera, and an image analysis of the data is performed. In accordance with the synchronicity interaction model, a Compurter Graphics embodiment either follows the movement of the hand of the partner with high synchronicity or goes away from the hand of the partner with low synchronicity. When one touches the Computer Graphics embodiment of the partner, a vibrator gives him or her a simulated feeling of touch. The heart rate sensor measures the timing of the heart, which is processed by the PC and outputted (Figures 8-1 and 8-2).

### 4.2 Software Configuration

A Heart Rate Analyzer is used to analyze the input data and to send the data to the Event Control as event data. The Event Control sends the heart rate data as MIDI commands to a MAX/MSP program on a Macintosh and some commands to the Computer Graphics Generator if some Computer Graphics need to be changed depending on the synchronization interaction model. The Computer Graphics Generator creates Computer Graphics based on these commands and outputs the Computer Graphics. The MAX/MSP program processes the sound data and the heart rate sound as required and then outputs the result. The Image Recognition analyzes the image data fed from the CCD camera and the relational information of the hands, and the Computer Graphics displayed is sent to the Event Control and the Computer Graphics Generator. The Event Control sends some commands to the Computer Graphics Generator if some Computer Graphics need to be changed depending on the data (Figure 9).

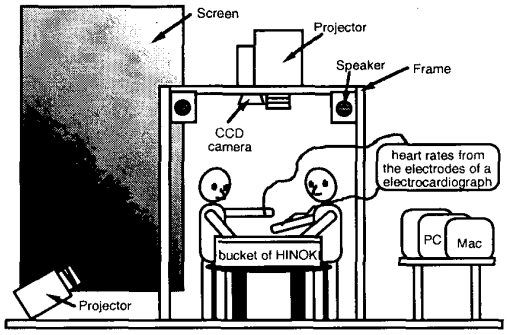


Figure 8-1. Setup of [Unconscious Flow]

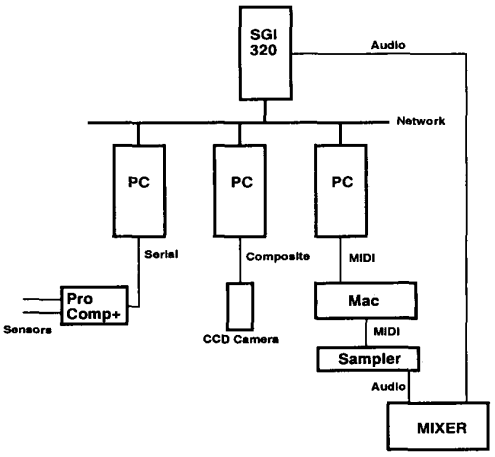


Figure 8-2. Hardware configuration

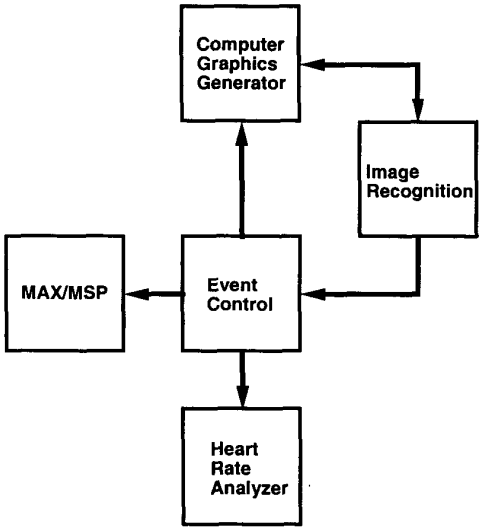


Figure 9. Software configuration

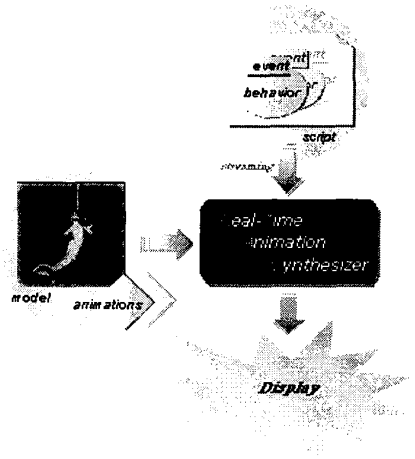


Figure 10. Real-time animation system

## 4.3 Computer Graphics Animation

This system uses the Real-Time Animation Synthesizer (RTAS) API for the mermaids' animations. RTAS is an API for creating interactive content with 3D Computer Graphics animation. RTAS is composed of two parts: Animation Synthesizer and Behavior Interpreter (Figure 10).

The animation Synthesizer has two functions to synthesize animations. One function is "Transition," and the other one is "Blending." This system mainly uses the "Transition" function. This function creates a "Transition" animation to smoothly connect the current animation with the next animation when an event occurs. the Animation Synthesizer can accept events at any time because the "Transition" animation is generated automatically. The Behavior Interpreter interprets scripts that describe behaviors representing high-level actions using animations (Figure 11).

In this system, the Event Control sends some scripts to the Computer Graphics Generator as events if some animations need to be changed.

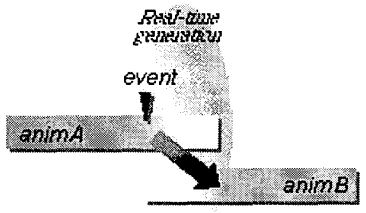


Figure 11. Real-time animation synthesizer

## 4.4 Hand Recognition

A marker held in each person's hand is recognized by using the CCD camera. The CCD camera recognizes the positions of two markers (Figure 12). The related program (Image Recognition) processes the distance between the two markers and determines whether a hand touches a mermaid or not.

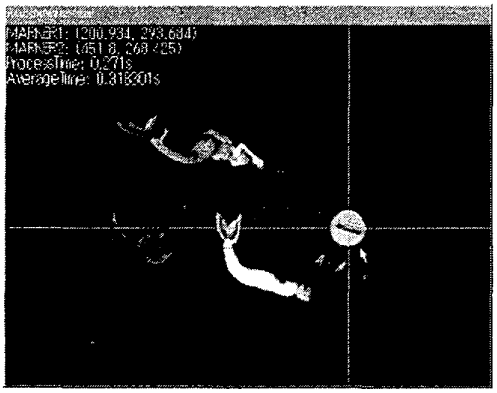

Figure 12. Image processing by hand recognition

### 4.5 Heart Rate Sensor

Each person's heart rate is measured by placing a BVP sensor on his or her finger. The heart rate is sent to a PC connected to the heart rate sensor (ProComp+) via RS232C and mapped on the synchronicity model depending on the heart rate (Figure 13).

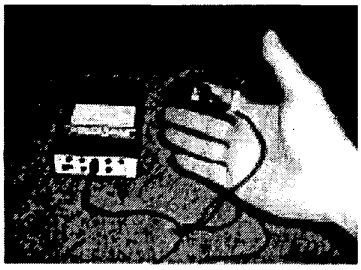

Figure 13. BVP sensor worn on a finger

## 5. Conclusion

This work was exhibited at SIGGRAPH'99 held in Los Angeles. Many people visited the exhibition site and enjoyed interaction with this Unconscious Flow. On the west coast, the idea of healing and meditation is quite familiar. That is the reason why this work accepted by so many people. To date, this work has been using a biofeedback function based on the heart rate of oneself. Other areas related to this work are sound healing and healing psychology. Future study will integrate Unconscious Flow with these areas.

Meditation and bio feedback with Interactive art will become very important in the future for human-to-human and even human-to-computer interaction. In the present day, people are exposed to various kinds of stresses in daily life. In human-to-computer interaction as well as in human-to-computer communications, people will want to have relaxed and less stressful communications.

## 6. Acknowledgments

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## 7. References

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