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Real-time 3D fluid digital art using BCI sensor

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Abstract. In this paper, BCI data is utilized for generating a fluid system digital art work. We measured spectator's EEG signal using MindSet to use spectator's emotional state when they appreciate the art work. We can get user's emotional state in 4 categories (attention / inattention, meditation / uneasiness) and this emotional state interacts with particle fluid animation in real-time. According to spectator's emotion, particle size and speed in fluid is changed. In this art work, each spectator experiences different fluid animation. We developed that fluid system is controlled by spectator's emotion. This system will be a new attempt in digital art field. Spectator's emotion is represented via the graphic water flowing.

Keywords: fluid animation, BCI, interaction

1 Introduction

From old times, spectator's emotion is important factor in whole art field. Recently, digital art field is one of the contemporary art. In digital art, there are many kinds of physical interaction when spectator appreciate the art work. In this paper, we used spectator's emotion to interaction. We can get spectator's emotion in real-time to use Mindset. BCI data is utilized for generating a fluid system digital art work. We measured spectator's EEG signal using MindSet to use spectator's emotional state when they appreciate the art work.

We can get user's emotional state in 4 categories (attention / inattention, meditation / uneasiness) and these emotional states are used to interact particle fluid animation in real-time. According to spectator's emotion, particle size and speed in fluid is changed. In this art work, each spectator experiences each different fluid animation. We developed that fluid system is controlled by spectator's emotion. This system will be a new attempt in digital art field. Spectator's emotion is represented through the water flowing. Figure 1 shows process of implemented real- time fluid system.

The following section will describe previous related work. Section 3 will provide the implement of real-time fluid system using EEG. In section 4, we will present the results of our research followed by our conclusions.

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Fig.1. Process of BCI real-time fluid system

2 Related work

2.1 EEG

EEG means the flow of electricity that is formed when signal is transmitted between cranial nerves. Left of Figure 2 shows waves of Brain waves. Right of Figure 2 is power spectrum. Power spectrum is converted result from raw data that is divided by the frequency and according to the state of mind.

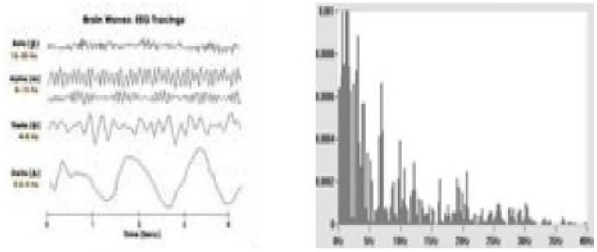

Fig. 2. Waves of Brain waves (left) , Power spectrum (right)

There are Delta waves (frequency 0.5-4Hz), Theta waves (frequency 4-7Hz), Alpha waves (frequency 8-13Hz), Beta waves (frequency 14-30 Hz) and gamma waves (frequency 30Hz and over).[1] Alpha waves are associated with meditation and relaxation, all types can also be attributed to attention or concentration at slower frequencies.[2] Beta waves are related to concentration.

2.2 MindSet

Standard medical EEG devices use a conductive gel to facilitate the reading of the signals. Dry active sensor technology does not need such a gel. For this reason, headsets based on Neurosky technology are very low cost, and easy to handle. [3] The MindSet(Figure 3) wireless Bluetooth headset features brainwave-reading and mental-state-translational technology from NeuroSky, Inc., a Silicon Valley company. With

earlier NeuroSky partner announcements in the toy (Uncle Milton Force TrainerTM, under a Lucas Licensing deal) and video gaming industries (Square Enix JudeccaTM), the Toshiba-NeuroSky product launch represents the first BCI peripheral directed to mainstream PC users.

Fig. 3. MindSet

3 Implement

Table 1. Emotional state fluid module.

Emotion	Expression of fluid using particle
Attention Inattention	Particle size
Meditation Uneasiness	Particle speed

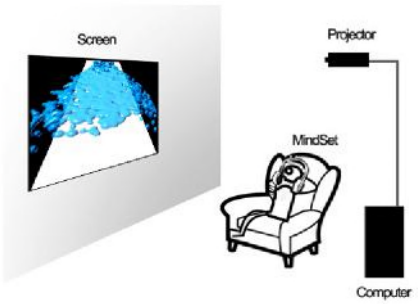

Fig.4. Art work flow plane

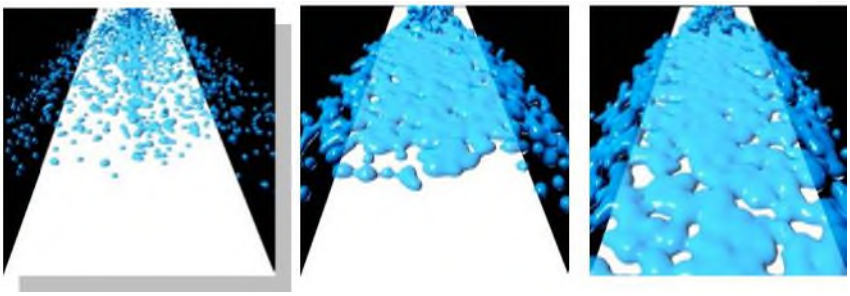

Fig. 4. Result images

As Table 1, spectator's emotion is measured in real-time and applied to fluid system and Figure 4 is flow plane. Figure 5 is result images.

4 Conclusion

We proposed real-time BCI particle fluid system. Each spectator's emotion form diverse particle fluid. Our work can express and visualize spectator's emotion. Spectator's emotion is represented through the water flowing. This system will be a new attempt in digital art field.

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