

Multi-sensory Musical Entertainment Systems

Zhiying Zhou*, Wei Liu*, Adrian David Cheok**, Xiangdong Chen*, Xubo Yang*, Michael Haller*

♣ National University of Singapore, ♦ Shanghai Jiaotong University, ♠ Upper Austria University of Applied Sciences

Abstract

This paper presents novel musical entertainment systems which provide users with multi-sensory experiences in creating and playing back music in a 3D tangible and physical environment. We applied multiple sensory modalities (visual, auditory, tactile, and expressive gestures) in our systems in order to create a system which could express a wide range of human-musical artifacts. During the process of creating and playing back of music, the user experiences a novel form of 3d-visual-speech, 3d-visual-sound (music and non-speech sound), visual-gestures, visual-tactile, and tactile-auditory perceptions. Apart from providing a multi-sensory experience, our multimedia systems also emphasize tangible human-computer interactions and communications in the context of physical environment.

Our system is an embodied (ubiquitous, tangible, and social) computing based augmented reality (AR) musical interface which regains the physical and social aspects of traditional musical entertainment. In “Bubble Beats”, users collaborate to create music in a chaotic and non-linear manner by physically capturing, bursting virtual augmented bubbles which contain musical pieces floating in the air, and dropping them down to a virtual playback “timeline”. In “Magic Music Desk”, users manipulate the virtual visual metaphor of musical resources in the physical environment by natural and intuitive interactions of hands and speech commands. A novel approach to visualize user’s speech in 3D, called “what you say is what you see” is applied. The instrumental object which the user speaks is seen as if it is coming from the speaker’s mouth as a 3D character (can be in different languages) and turning into virtual instrumental objects when it drops down onto the desk. This provides a possibility for multi-cultural communication and interaction. Expressive gestures are used to directly manipulate the virtual objects by hand.

A formal user study was conducted to examine the user’s reaction and feedback to the main features of our multi-sensory systems. This includes studying the multi-sensory experience using multimedia technologies in AR compared to traditional computer musical interfaces, the physical and tangible interactions, social interactions between users, and cooperation and collaboration between users. The results suggest that our systems not only integrate multiple modalities to increase the bandwidth of the human computer communication but also integrate ubiquitous, tangible, and social interactions between users which provide collaborative and shared multi-sensory experiences for musical entertainment. Thus, our systems re-invigorate computer musical entertainment system with social human-to-human and human-to-physical touch interactions.

Keywords: multi-sensory experience, multi-modality, augmented reality, human computer interaction, musical interface

* Corresponding Author: Adrian David Cheok, Dept. of Electrical and Computer Engineering, National University of Singapore, 4 Engineering Drive 3, Singapore 113576. Tel: +65-68745164, Fax: +65-67791103, e-mail: adrianchek@nus.edu.sg