Interactive Gesture Music Performance Interface

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Abstract
This paper briefly describes a number of performance interfaces under the broad theme of Interactive Gesture Music (IGM). With a short introduction, this paper discusses the main components of a *Trans-Domain Mapping* (TDM) framework, and presents various prototypes developed under this framework, to translate meaningful activities from one creative domain onto another, to provide real-time control of musical events with physical movements.

Keywords
Gesture, Motion, Interactive, Performance, Music.

INTRODUCTION
With the advancements of computing, electronic and sensors technologies, and growing excitements in inter- and multi-disciplinary research, there has been increasing interests in new musical instrument interface design, including:

- augmentation for traditional instruments with new capabilities, for examples, controlling synthesis parameters, visual output or triggering sound samples, and
- new interface designs [4], physical or virtual, to provide better ergonomics considerations, and/or offer simpler instrumental control to a wider users.

With such systems, the mode of interfaces, mapping, sensitivities and reactions (output) are extremely flexible and can be dynamically configured or personalised, to allow:

- better access to musical instrument control (e.g. to overcome physical limitations), and
- playing with shorter learning time.

This paper presents a number of performance interfaces under the broad theme of Interactive Gesture Music.

TRANS-DOMAIN MAPPING (TDM)
TDM can be viewed as a translation function, which translate activities of a creative domain onto another. This basic framework consists of four basic modules:

1) Input sensing and data acquisition: This module interfaces the framework to the real world environment.
2) Feature detection and tracking: This module contains algorithms to locate and follow certain predetermined features in the input data, e.g. colour.
3) Mapping: This is made up of an extensible set of functions, which reacts to the detected features by generating an appropriate output.
4) Output and simulation: This module is responsible for outputting multimedia events, e.g. playing an audio file.

Mapping
Mapping strategy presents a vital design and interface challenge for new instruments design [2, 5, 6]. The interface designs as describe in this paper explore various different modes of mapping depending on the context of the specific application. For example, in order to provide clear and direct relationship of motion and sound, the MvM/CoIN interactive dance performance (see later Section) starts with simple *one-to-one* direct mapping with simple motion. As the performance progresses, the mapping strategies becomes more abstract, exploiting complex relationships and multi-layered mappings. This seems to work well as it allows audiences to follow the performance with increasing understanding and appreciations. However, this is by no mean a generic model.

Music via Motion (MvM)
Theremin could perhaps be considered as the best known and successful "*New Interfaces for Musical Expression"* of the 20th century. It exhibits good features of a musical instrument (simple interface but expertise can only be acquired with training and practice) and it offers *virtual* interface since the player does not physically in contact with the instrument.

Initial design of MvM is very much motivated by this interface design to track hand gesture to control musical events. Following the TDM framework, MvM uses live video data as input. It detects and tracks visual changes (motion and colour) of the scene under inspection using Computer Vision approaches, and make use of the detected changes to generate/trigger interesting and *relevant* musical events, with an extensible set of mapping functions [3].

The Coat of Invisible Notes (CoIN)
CoIN brings together multiple creative domains to build specially designed costumes, music and dance within an

interactive audio-visual augmented environment simulated by the MvM system.

The costumes (see Figures 1) in this project are specially designed to be re-configurable, in order to achieve different visual effects, which in turn are detected by MvM.

Figure 1. MvM/CoIN performance.

For CoIN performances, MvM is configured to track the colour where visual changes were detected, and this information is being used to control the choice of musical sound and effects. This feature is particularly apparent in a section of the choreography where the dancers are divided into two groups, wearing costumes in different colours (see Figure 2). The contrasting movements and interactions between the two groups create interesting musical dialogues with two different musical sounds.

Figure 2. Musical dialogues using colours.

Distributed Multimedia Mapping Server (DMMS) and Interactive Music Head

With the basic TDM framework as discussed above, many other existing visual tracking and sensing system could be integrated. In order to provide seamless integration, the mapping module has been redesigned to communicate via socket connection, to ease cross platforms integration and offer distributed processing.

DMMS was first tested with a real-time face (and facial expression) tracker from another ongoing research project, which aims to create a synthetic talking head intended for mediating interaction between humans and machines [1].

With the DMMS, changes with each face feature (e.g. right-eye, mouth or other features) can be mapped onto one or more MIDI channels or other multimedia events, with independent configurations (see Figures 3).

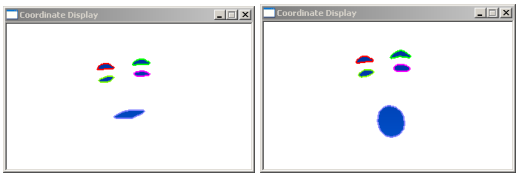

Figure 3. Reconstructed face.

CONCLUSION

This paper briefly presented a number of IGM performance interface designs, to provide interactive multimedia control, which could be used for augmented performances, installations and many other related applications.

Beside added dimensions of controls and interactivities, developments in this field could provide assistance to widen access and participation for a wide range of practical based performing arts.

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