??? Paper Title ???

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ABSTRACT

The abstract should preferably be between 100 and 200 words.

Author Keywords

sonification, ???

ACM Classification

H.5.5 [Information Interfaces and Presentation] Sound and Music Computing, H.5.2 [Information Interfaces and Presentation] User Interfaces—Haptic I/O, I.2.9 [Artificial Intelligence] Robotics—Propelling mechanisms. ??? **TO DO**

1. INTRODUCTION

- motivation
  - challenges
  - the Vicon system

2. STATE OF THE ART

- Vicon & related projects
  - interactive / movement sonification examples[1].
  - "Sound in space" represents another inovative element in this project because introduces the concept of tactile sound. Is not about the **localization** of sound in space, is about the **position**, the coordinates of sound in a real space, like an *object*. Sound objects concept represents an inovative tool for multimedia arts involving sketchs, imaginary games and and realtime interactions.

3. PROJECT DESCRIPTION

3.1 Concept

- Performance aesthetic
  - Gestures, virtual objects, dynamic mapping
  - Visual environment

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3.2 Implementation

- Character design (Nexus)
  - Vicon extensions (SDK plugin)

3.2.1 Max modules

- Objects generation & performance mechanics

Max is a realtime visual programing environment for music and multimedia arts that helps you build stand-alone applications, plugins and mixing audio signals. In order to create interactive sounds, attractive grapichs and special effects, MAX creates a connection between virtual objects and subpatches[1]. Manipulating objects algorithm consists of 3 big steps: object generation, finding the object and releasing the object on the floor. Object generation is realized by random generators with the help of *drunk* object, but with certain limits. These limitations are influenced by the dimensions of the room in which the Vicon system is installed. Finding the object supposes continuous mathematic operations between the coordinates of the object and coordinates of the left hand's marker. This process comes with an audio feedback. When these coordinates are close enough one to another, the object is retreived and manipulated by performer (eg. define gesture). After all these processes, a simple comparison between the coordinates of the floor and the value of the z axes of the marker is done in order to put down the object. According to this, a performer can handle as many objects as he wants.

- Gesture recognition

Interaction between sound control and human gesture has constantly increased over the last years [2]. Probabilistic models for analysing motion and sound relationships became a necessity and a forthcoming tool [3]. *Mubu* containers provided by Ircam laboratories in MAX/MSP software represent a handy tool to record and analyze gesture, captured with Vicon system [4]. Our gesture recognition algorythm is based on Hierarchical Hidden Markov Model implemented in *mubu.hhmm* object of MAX/MSP. Hierarchical Hidden Markov Model is a generalization of HMM where each state is considered to be a self-contained probabilistic model [5]. The system is trained by captured data which is essentially a gesture. This process requires a predefined indicator in order to delimitate gestures from all data

[1]See `http://www.cycling74.com/`.

flow. The algorythm analyzes all input data and generates a probability of similarity between data and saved gestures. In order to control every generated object, there are associated 2 or 3 gestures saved by the performer, but there is a limited time for the gestures to be executed. Predefined gestures offer the possibility to delete the gesture just saved and also indicate the moment the gesture is recorded. to be continued...

- Sound design
- Visualisation (jitter)

4. CASE STUDIES

4.1 Interactive Installation

4.2 Performance

- Solo / duet / tutti ...

5. CONCLUSIONS AND FUTURE WORK

- Areas of improvement
  - Eye tracking?

6. ACKNOWLEDGMENTS

This section is optional; it is a location for you to acknowledge grants, funding, editing assistance and what have you.

7. REFERENCES

[1] T. Hermann, A. Hunt, and J. G. Neuhoff. *The sonification handbook*. Logos Verlag Berlin, 2011.

[2] K. N. Jorge Solis. *Musical Robots and Interactive Multimodal Systems*. Springer-Verlag Berlin Heidelberg, Berlin, 2011.

[3] R. B. F. B. Jules Francoise, Norbert Schnell. Probabilistic models for designing motion and sound relationships. *International Conference on New Interfaces for Musical Expression*, pages 287–292, June 2014.

[4] D. S. G. P. R. B. Norbert Schnell, Axel Robel. Mubu and friends assembling tools. *International Computer Music Association*, pages 423–426, August 2009.

[5] N. T. Shai Fine, Yoram Singer. The hierarchical hidden markov model: Analysis and aplications. *Machine Learning*.