

# ??? 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[2].
  - *Sound in space* represents another innovative element in this project because introduces the idea of *controlling sound* by movement. This means that the sound is an entity, gets a materialization and it becomes switchable [1]. It is not about the **localization** of sound in space (detecting the direction of sound source), it is about its **position** in space, the coordinates of the sound object in space, like an actual *object* in a room. *Sound objects* concept represents an innovative tool for multimedia arts such as sketches, imaginary games and realtime interactions.

Interaction between sound control and human gesture has constantly increased over the last years [3]. Probabilistic models for analysing motion and sound relationships became a necessity and a forthcoming tool [4].

## 3. PROJECT DESCRIPTION

### 3.1 Concept

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

### 3.2 Implementation

- Character design (Nexus)

#### - Vicon extensions (SDK plugin)

Vicon's SDK is a versatile and simple tool for users to gain easy access to Vicon DataFlow created in Nexus, Blade or Tracker applications. The Vicon DataStream Software Development Kit (SDK) provides intuitive programable access to data with custom functions created in C++. With the help of some functions, Vicon's SDK forwards the Vicon DataStream to other constructive softwares and plugins to create custom applications<sup>1</sup>. In combination with Open Sound Control protocol, Vicon's SDK forwards data to any software compatible with this communication protocol (eg. MAX/MSP). OSC is a protocol for communication among computers, sound synthesizers and other multimedia devices<sup>2</sup>. Hence, any marker can be routed in MAX/MSP using its parameters and coordinates. Also, the Vicon DataStream Software Development Kit (SDK) admits inside changes such as labeling markers, timecode generation and framerate.

#### 3.2.1 Max modules

#### - Objects generation & performance mechanics

Manipulating objects algorithm consists of some big steps: object generation, finding the object, picking up the object, throwing 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 retrieved and manipulated by performer (eg.

<sup>1</sup>See <https://www.vicon.com/products/software/datastream-sdk/>.

<sup>2</sup>See <http://opensoundcontrol.org>.



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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**

*Mubu* containers provided by Ircam laboratories in MAX/MSP software represent a handy tool to record and analyze gesture, captured with Vicon system [5]. Our gesture recognition algorithm is based on Hierarchical Hidden Markov Models (HHMM) implemented in *mubu.hhmm* object of MAX/MSP. HHMMs are a generalization of HMM where each state is considered to be a self-contained probabilistic model [6]. 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 flow. The algorithm 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**

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