Sonic City: Merging Urban Walkabouts With Electronic Music Making

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ABSTRACT
We describe a first implementation of the technology used in *Sonic City*, an on-going project aiming to transform the experience of a user walking through an urban environment into a dynamic and real time music creation process.

KEYWORDS: Musical interface, urban environment, context-awareness, wearable, mobility, interactive music.

INTRODUCTION
The goal of the project is to enable people walking in a city to create electronic music in real time through everyday interaction within the urban environment, literally playing it as a musical instrument. This paper describes a first implementation of the prototype developed for this purpose, using wearable and context-aware computing, as well as interactive music technology. Real time perception of context and action in an urban setting is mapped to dynamic parameters in musical creation, including content, structure and features: music is created algorithmically as a direct result the user's movements, their path through the streets, the physical landscape surrounding them, the type of activity going on around them, as well as the way this wearable system is worn.

Our intention is to expand the scope of personal musical expression and creativity by including mobile behaviours and interactions through the city as parameters in electronic music making. Mobility in multiple and shifting contexts can be seen as gesture in a larger scale, as means of generating audio content through physical movement (e.g. [7]) – in this case movement through the urban landscape. Sonic City is related to other projects linking urban settings and music such as Noiseman [1], Sound Mapping [4], Nomadic Audio [3] and CoseTune [5]. From a more technical perspective, this project is also a novel mobile application of context-aware computing.

DEMONSTRATION
Given the indoor nature of the conference venue, the prototype cannot be demonstrated in context (in the streets of Paris). Therefore, we intend to show the overall functions, experience and musical output using interactive simulations of use scenarios, as well as complementary video materials and tangible prototypes for visitors to try out.

PARAMETERS OF INTERACTION
Both user and environmental conditions determine how the music is generated by the system in real time. The overall musical structure is shaped and modified by:
- contexts the user walks through, defined in space, time and activity (f. ex: busy street in the evening);
- patterns of user actions (f. ex: crossing a street).

By choosing paths that would lead him/her to particular contexts and actions, the user thus controls the overall structure of the music. After mini-ethnographic studies of urban sites and behaviours, urban contexts and patterns of actions have been conceptually divided into basic characteristic units that can be used for context and action recognition as well as musical control:
- continuous factors: physiological states (f. ex: heartbeat rate), actions over time (f. ex: heading north, pace) and ambiances (f. ex: open/enclosed space, pollution level);
- discrete factors: punctual user actions (f. ex: stops, proximity to walls, turns), environmental events (f. ex: car horn, street lights, presence of metallic objects).

The articulation of micro-level musical parameters is determined by the user and environment through the discrete factors. The continuous factors modulate macro musical elements such as the tempo. Besides adapting their behaviour and path to get wanted musical qualities, users can interact with the system with tangible means and by customising the way the system is worn.

PRELIMINARY IMPLEMENTATION
The current prototype is a quick and simple platform for which to explore the user experience. It will soon be further developed technically in an iterative process.

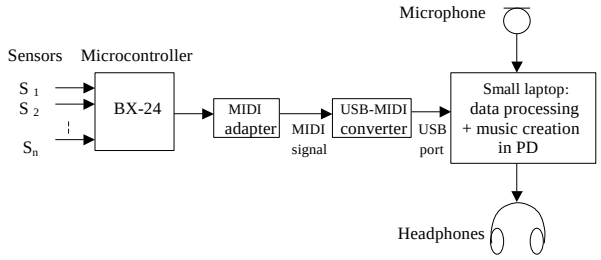

Figure 1: First hardware implementation.

Hardware

Wearable biometric and environmental sensors are worn onto the user's body and clothes. For the sake of simplicity, only the most significant ones (light, sound pressure level, air pollution, blood pressure, ultrasonic distance sensors and digital compass) are used in this first implementation. An electromagnetic field sensor, accelerometers, GPS, a metal detector and pressure sensors will later be added. The way the sensors are worn and positioned on the body can influence on what is being sensed and thus on the kinds of musical patterns generated. Therefore, their positioning is designed to be flexible in order to allow for more user control and expression through customisation. The sensors data are collected by a BasicX-24 microcontroller, which sends them in MIDI format to a small laptop computer (to be carried in a shoulder-bag) via a USB-MIDI converter (Fig. 1). The data is then reconverted and processed on different levels, and music output through headphones by a program created in the interactive music environment PD.

Software

Context and Action Recognition

A context and action pattern recognition program is under development. However, during preliminary development, basic PD modules based on simple algorithms of "if-then" type are used, allowing for further development of the other aspects of the prototype. In the final application, the sensor data will be translated into characteristic cues, which will then retrieve contexts and patterns of action [6].

Mapping

Instead of simple one-to-one mapping, models currently explored are that of many-to-many and multiple layers mapping [2], based on the different levels of abstraction developed in our interaction model: retrieved parameters with higher level of abstraction such as context and action are mapped to music parameters on a macro level, while certain raw data are mapped directly to micro musical parameters. These indirect, complex and abstraction-based models allow for more expression and flexibility [2].

Algorithmic music

Structurally, the PD program is composed of small modular units that construct the music algorithmically according to what factors trigger them, and to the values of the data mapped to them. This modularity and the flexibility of the mapping models enable us to easily test various types of musical output. Working in close collaboration with the sound artists 8Tunnel2 [8], we are exploring a range of audio content, from synthesized sounds to real time processing and sampling of concrete urban sounds. In this way, we also intend to enhance the link between the existing urban soundscape and the music.

CONCLUSIONS AND FUTURE WORK

We have described the current state of our project Sonic City, which aims to merge urban walkabouts with electronic music making. We will continue developing the prototype and designing more sophisticated interaction models. Sonic City is also a platform for testing social, cultural, and artistic implications of mobile music creation. Rather than making assumptions about how people would use such a technology, we intend to use participatory design methods and iterative prototyping in order to test speculative ideas, emerging user behaviours, possibilities for personal creativity, and new ways of using the city.

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