BEATWEAR

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ABSTRACT

Beatwear consists of a pair of drum-gloves, used to create and explore music in an untraditional way. Essentially, they represent a new form of music composition.

The gloves generate different percussion sounds (also with different effects) depending on which fingers strike the surface, with which velocity it is hit and whether or not the surface is metallic. This is achieved by using sensors that register pressure, conductivity and the bending of fingers. Different sets of drums (e.g. electronic, classical, rock, hip-hop or drum'n'bass) can be chosen and your beat can be accompanied by different background-rhythm. You can enjoy your self-created music publicly through speakers or privately with headphones.

Keywords

Music interface, interaction design, ubiquitous computing, amusement, computer technology, drum-gloves, musical expression, digital instrument.

INTRODUCTION

When listening to and enjoying music, one can easily feel the rhythm pulsating through the entire body.

Most people find themselves moving to the music, and often use their hands to drum on their knees or other surfaces nearby. This type of human behavior gave birth to the concept of Beatwear

The project is based on the gloves being used for personal or public entertainment purposes and it is not a scientific in nature, considering the fact that our goal is not trying to generate the perfect sound, and our target group is not the professional musicians. Professional musicians often have a strong bond with classical instruments they use and the traditional sound they generate. Some of them even consider the sound from the synthesizer, which has existed and been under development for several decades now, as fake and unnatural.

We want to encourage peoples' lust for exploring sounds, and how one can affect sounds in different ways, even if the user is not able to play acoustic instruments. With the development of computers and it-artifacts, more people have started to take an interest in creating computer-generated music. It has become easier to access music composing software, and they are also becoming easier to use.

Music has always been connected to the joy of life, and man has showed an enormous amount of fantasy in developing instruments and creating music. Music is highly individual; enjoying music is not only limited to the ears, but also several other senses. We also put a lot of aspects into music, like memories, joy, sorrow, lust, anger, physical movement and so forth. It affects us. Music is a toy, a storyteller and a way of communication.

RELATED WORK

Looking into the area of electronic music, one realizes that there is no limit to peoples' imagination and the joy of discovery and lust for experiments. The history of electronic music goes far back in time [2] to 1876 with Elisha Gray´s Musical Telegraph, followed by William Duddel´s Singing Arc in 1899. In 1970 Moog music released the MiniMoog, which transformed the following synthesizers to become portable. This was a request from musicians on tour, who easily wanted to move their equipment. The first percussion interfaces came to light in the late 1960´s, but the first widely-marketed drum interface, the Moog 1130 Drum Controller introduced in 1973, exposed synthesized drums to the audiences in big concerts with rock bands such as Emerson, Lake and Palmer. In about the same period of time, the electronic music interfaces took a huge step from being portable to being wearable. It started off in 1971, when the composer Gordon Mumma inserted accelerometers and wireless transmitters in dancers belts for performances.

Since the early 1980´s, Benoit Maubrey has been designing "electro-acoustic clothing", inserting tape recorders, speakers, samplers, sensors and synthesizers into performers clothes. The big name during the 1980's was the New York performance artist Laurie Anderson, who designed a drumsuit from the triggers belonging a set of electronic drums. During the performance, she generated sound by tapping different sections of her body. This led to several commercial companies producing such garments, and later on improving suits with sensors so that they could measure motion, gestures and so on.

A music controller in various appearances is another area that started to develop during the late 1980´s. Laurie Andersson performed with a necktie that had a music keyboard inside it. At the MIT media lab they built a musical jacket with a touch sensitive MIDI keyboard embroidered into a Levis denim jacket using conductive thread. They have also made a set of "expressive footwear" that measures several dynamic parameters expressed at the dancer's foot, like pressure, tilt, height, orientation, angular rate and position.

Gloves are popular tools in music-performances, and many of these controllers come from STEIM, the Dutch Studio for Electro-Instrumental Music research in Amsterdam. In 1984 a performer called Michael Waisvisz built "Hands" that consisted of a pair of plates strapped to the hands with keys for fingering and sensors that responded to thumb pressure, tilt, and distance between the hands. Waisvisz still uses this expressive controller during his performances for improved gestural and sensitive control over the sounds produced. Many composers, e.g. Richard Boulanger at the Berkeley School of Music in Boston, have used the Mattel's "Power Glove", a magnetic tracking system built to control VR-systems, as a controller of audio and synthesis parameters during performances.

Around 1991, Laetitia Sonami developed an electronic glove made from latex rubber, and later on she called it the "Lady's glove" created in golden lycra material. The only visual clues of its function are five micro switches on the fingertips, for tactile control. It contains bend sensors to measure the inclination of both finger joints for the three middle fingers, hall sensors to measure distance of the fingers from a magnet in the thumb, pressure sensing between index finger and thumb, and sonar ranging to emitters in the belt, shoe or opposite arm.

PROTOTYPE DESIGN
Getting started with a computer-based instrument should be relatively simple, in contrast to acoustic instruments played for the first time. In Beatwear, a graphical user interface, with two hands, is visible on the computer screen to the user. Within this picture, musical material is selected and then dropped onto a musical process. This is a natural application of Lakoff's movement and container metaphors [1].
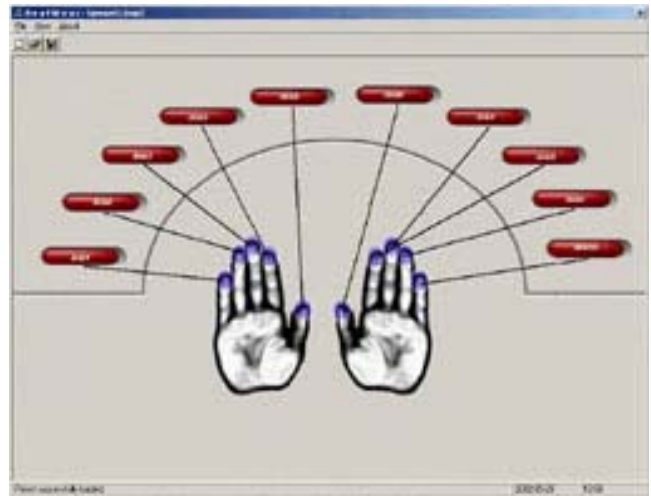
The prototype has been developed in Visual Basic using the Microsoft DirectX 8.1 API.

The electronic components were attached to a black pair of gloves. These were originally meant to be used by golfers, and were chosen due to the material and appearance. The upper side of the hand is made of fleece, and the palm side is made from cloth covered in latex. There are eleven sensors on each hand (five for pressure, five for conductivity and one for bend) and cables connecting them to a microprocessor, which was placed in a box. On the back of the hand a Beatwear-logo was attached.

Below the visible part of the pressure-sensors, the homemade metallic sensors are sewed in. They consist of two different metallic wires that don't have any electrical contact with each other. When they strike a metallic surface a closed circuit is achieved.

On the middle finger, a much longer sensor is attached, a sensor that reacts to bending.

To protect the electronics inside the gloves, and also to make them more comfortable, separate cotton gloves were sewed on to the inside of the gloves

INTERACTION

Before using Beatwear for the first time, one has to customize a few things. To be able to personalize sounds, one has to use the computer. By using drag-and-drop functionality, one assigns different percussion samples to different fingers. The user can choose to use just one drum for the entire hand by dragging it to each finger, or user different drums on each finger.

When the pressure-sensors register a hit, the corresponding drum sounds will be played. If the surface is metallic, the conductivity sensors register it and a metallic effect will be applied to the drum sound.

When bending the finger, the type of drum kit will change; bending the left middle finger the previous drum kit in the list will be selected, while bending the right will select the next one. The different drum kits the user currently has to choose from are rock, drum'n'bass and synth.

It is also possible to add a background rhythm to accompany the drumming. Toggling it is done by bending both middle fingers simultaneously.

Problems

Often when creating a computer based music controller the latency [3] proves to be a big issue. While playing acoustic instruments, there is no noticeable latency (only the time it takes for the sound from the instrument to reach your ears). There is a direct contact between the performer and the physical sound production mechanism. In computer based instruments this process gets more complex. Sensors are used to capture gestures, and then the computer is used to generate the sound. Here you've lost the one gesture to one acoustic event, and then the latency comes in to the picture. To electronic music performers low latency is essential [3]. If the sounds that are generated by the instrument are not heard in real time, the musician loses the sense of playing. Beatwear's audible reaction to gesture is within the margin compared to the acceptable upper boundary we had expected. We discovered that there was an increased amount of latency when attempting to measure the velocity

of which a surface was hit by the pressure sensors. Because of this, it was decided this functionality should be left out.

When working with gloves, a big problem is finding a size that can fit as many people as possible. The material in the gloves we've chosen can be stretched to a certain degree, and broadens the user-group for the prototype. Beatwear is almost unusable when the users hands are too small, as the fingers will not be long enough to control the pressure sensors.

During time, the user should be able to develop as a musician, and gain some of the degree of the musicality of the traditional acoustic instruments. This since the user will get more used to the new musical interface, and is able to choose more difficult comp-beats. In contrast to classical instruments, Beatwear has a low entry fee when it comes to ease-of-use.

Experience

Beatwear has been exhibited at a student exhibition in Gothenburg in May 2002. The visitors were able to test the gloves, and give feedback about the concept. Discovering the joy and excitement the musical experience gave the visitors we found that we have succeeded in finding a new interface for people to communicate in the universal language called music.

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