InstrumentAll: a Virtual Instrument

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Abstract

In this paper we describe InstrumentAll, a musical interface that uses a transparent tablet as an input device. The tablet was developed for the investigation of rhythmic ability in bimanual coordination. The interface, InstrumentAll, a first prototype for the investigation of the tablet as a musical instrument, has only three controls that allows to select instrument, percussion and musical pattern. Despite its basic simplicity, surprising results were obtained. New possibilities for the interface design and interaction are suggested. The transparent tablet and InstrumentAll proved to be appropriate for the study of human perception.

1. Introduction

Nowadays, a great effort is devoted to understanding which mechanisms are responsible for driving the movements and which processes occur in their learning. In particular, the study of rhythmic ability in bimanual coordination [1] is becoming the object of intense research, in order to determine the space and time patterns that characterize the movement and to understand the basic principles and mechanisms that are guiding the system to present specific coordination patterns. Computer systems are very attractive for this usage due to their capabilities for the processing, storage and exhibition of information, if they can be used with special devices that detect the response of both hands in real time.

Since these peripherals were not available, we developed a transparent and resistive tablet that can operate with two pointers, one for each hand. The tablet can be fixed directly on the computer video screen or operated on a common table. In short, the tablet architecture was conceived so that it may be connected to any equipment with an RS232 serial interface, which makes the software development very easy.

Besides the device driver, the development includes software for the specific application in the rhythmic ability investigation in bimanual coordination, RitSens [2]. RitSens produces static and dynamic, visual and oral stimuli, allowing the determination of the spatial and temporal right and left hand responses. The visual stimuli consist of targets with shape, size, distance, orientation and colors that can be defined at each test and presented in the computer screen. The system allows the determination of the initial and final time for the user response time. For each response, the time and the x and y coordinates of the touch are registered, both for the right and the left hand. In this way, the temporal and spatial patterns produced by the user may be analyzed.

In its preliminary version RitSens worked with the common sound library available in the computer, but in the last version a MIDI driver was added so that any MIDI sound program can be related to an aural stimulus and played. The operation with the MIDI protocol opened the possibility of the transparent tablet as a musical instrument, fixed on the computer display, or played on a common table. To active this goal, a new software named as InstrumentAll, was developed to be used as a musical interface. This first prototype was approached as a demo, exploring the tablet possibilities to produce musical events in real time. Despite its basic simplicity, surprising results were obtained.

Next, we describe the transparent tablet and how InstrumentAll arose. Following, we approach how the system hardware and software can be applied in the study of human perception.

2. The transparent tablet

The transparent tablet [3] was made with rectangular plates of calcium-sodium glass, with dimensions of up to 15 inches diagonal and 2 or 4 millimeters width. These dimensions can be easily customized. The glass plates are covered with a thin film of tin oxide and the plates of conductive glasses are mounted in a light frame, that can be easily fixed on computer screens. This assembly also allows the tablet to be used on a table.

Electronic commutators are applied to independently feed the resistor in the x and y directions, isolating the horizontal and vertical contacts of the plates with diodes uniformly distributed around it. The input of the coordinates occurs when a pointer, or conductor pen, directly touches the transparent film. When a DC tension is applied, the pen input tension is translated into (x, y) coordinates. A special graphite pen was developed in order to reduce the friction with the surface of the conductor and transparent film.

Fig.1. RitSens and the transparent tablet being operated.

In short, the tablet architecture was conceived so that it may be connected to any equipment with a standard RS232 serial interface, which makes the software development very easy.

2.1 The Musical Interface

The use of the General MIDI Standard allowed the use of several MIDI programs. In this version, we used the serial interface previously designed for the study of rhythmic abilities to produce a sequence of music events ordered as trajectories of a harmonic buffer. In this application, the sound responses are determined by the touches on the tablet. The system allows the determination of the initial and final time for the user response time. For each response, the time and the x and y coordinates of the touch are registered, both for the right and the left hand. In this way, the temporal and spatial patterns produced by the user may be analyzed.

The musical interface is depicted in Fig. 2. At right, there is a square region, or electronic pad, which is associated to the tablet area. The left and right of the electronic pad are associated to sound control regions. These regions allow to selecting the MIDI program (music instrument) (top), percussion sounds (middle), and musical pattern or pre-defined musical trajectories (bottom). The selection occurs by touching the region with the pointer. In this first prototype, the interface was designed just to try the possibilities of the tablet as a musical interface. When the touch occurs in the performance region, a random-walk procedure to produce a trajectory in a pre-defined musical and the pair (x,y) is associated to MIDI Note and Velocity respectively. This selection allows the user to listen to the instrument selected in the General MIDI table. Similarly, when the touch occurs in the percussion region (drummer) a percussive sound is heard.

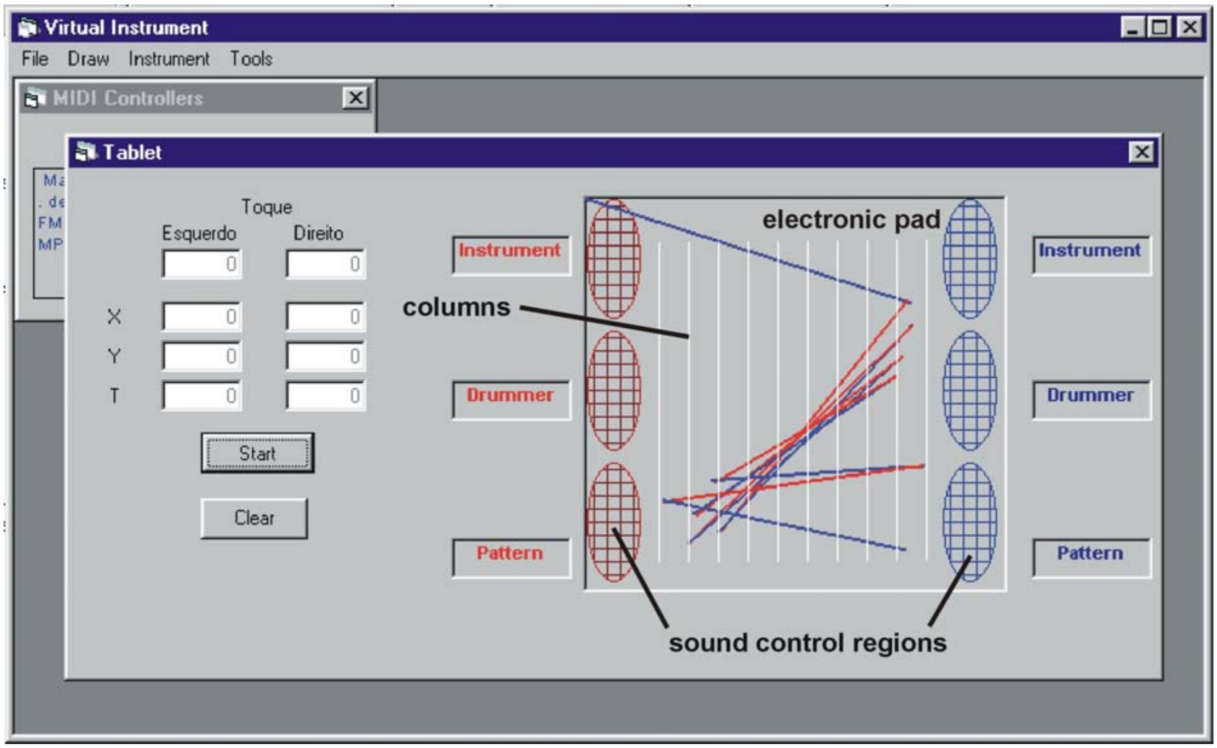

Fig.2. The musical interface.

The pattern selection procedure is associated to the performance region (middle region). In this first prototype there are three patterns available. The first one was associated to chords performed by a steal string guitar. A sequence of chords is related to columns in the transparent pad, and a touch in the column produces the chord in the loudspeakers. There is a different sequence associated to each musical pattern.

To create a visual feedback, when a touch occurs, a line is drawn connecting the touched point with the previous one. There is also an association of colors: red to left and blue to the right pointer. This pattern of colored lines can be interpreted as a sketched partitur in the computer screen. The coordinates of the touched points, as well as the touch duration are displayed in the fields at left, but these are information for checking the device, they are not relevant to the sonic judgment of the musician. Neither all the available instruments in the MIDI board were suitable to the few control functions of the interface. Long voices instruments, like flute, for example, “play” indefinitely if not stopped.

2.2 InstrumentAll

The musical interface and the tablet were presented in academic, scientific and commercial events, instigating a lot of curiosity in each community. While interacting with the system, a sketched score arose in the computer screen. In a first moment, people explored this new “instrument” trying to understand it. But after exploration, some people with musical skill found a set of parameters to play comfortably, and started to produce interesting musical sequences. Some players were driven to the music itself, the images appeared in the screen as a secondary result of the performance. Others, players were driven by the images, exploring visual patterns, and the music was a consequence of this exploration. New possibilities for the interface design were delineated, operating with only one instrument associated to the tablet region and with different features mapped in different regions, until a possible whole orchestral configuration of instruments. Similarly, new possibilities of interaction emerged, through lines, regions and even animation, using “dynamic scores”, in which the characteristics of the tablet regions could change with the time. InstrumentAll emerged, as a Virtual Instrument for All, or at least almost all, since it is very easy to interact with it.

2. 3 Acquiring judgement

Musicians compose for many reasons: for pleasure, because the pianoforte happens to be open, for expressing feelings, for no reason whatsoever. But what if the artist claims to address no audience - not even himself? The work may still be of aesthetic value for those who happen to appreciate his purposeless output. In the limit, suppose that some randomly musical generated items are judged by an audience in terms of their aesthetic values [5]. Some scores are better than others. These are selected and mutated to yield new items. This process continues until results of sufficient value have evolved. But this natural evolution of art is too slow and cumbersome. Why not monitor the successive judgments of the audience, characterize their expressed values, or acquiring judgement, then simulate this objective function in order to efficiently search the immense space of possible items for those that are of sufficient aesthetic value for that particular audience? The more homogeneous the audience, the easier this should be. On the other hand, if the audience is so diverse that there is no common aesthetic value, the attempt to capture this policy will fail [6].

Like Vox Populi [7], which was designed to be flexible enough for the user to modify the music being generated, InstrumentAll is appropriate for the study of human perception, because the choices, interactively made by an user working as an musician can be recorded. These choices can then be applied to train neural networks, which in turn may be used in composing systems. The generated aural and visual patterns hold the promise of recovering information that could be used to model a sequence or cognitive structure that underlies a musical design.

3. Conclusion

InstrumentAll is a musical interface inserted in the context of the computer interactive composition. It includes those applications that use the computer in the frontier between an instrument, in which the user "plays", and a compositional tool, in which the user tries, looking for a varied and stimulating sound material. Nowadays, we are confronted to new musical technology that links the creation of a piece of music to the performance. Play and create, at the same time. Instead of producing complex grammar to control the act of create music at a macro level, the real-time interaction leads to a process of dynamic and evolutionary creation. In music history there was always a space for improvisation, since the Bach organ improvisations to a Jam session nowadays. Nevertheless, graphic power connected to appropriated hardware, can be used in new performance situations. This is the main challenge of the research presented here addressed by creation of the InstrumentAll.

It is interesting to verity that InstrumentAll allows the creation of different musical interfaces that can fit an instrument, a set of instruments or even one or several orchestras. These interfaces may be programmed in order to accommodate different composition paradigms, already existing or demanding to new ones. In the first interface created for InstrumentAll, few features allowed nice musical sequences to be played using the tablet, highlighting its potential as a musical environment. Moreover, because of its two pointers the tablet is easily related to percussion instruments, providing the physical manipulation that lacks in most of computer musical environments. People play music gliding the pointer on the glass, the touch sensation is very nice. The movement lines are shown in the computer screen through sketches, suggesting a drawing score, or a music that is being drawn. Many are the visualized possibilities of using the tablet as a musical instrument.

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