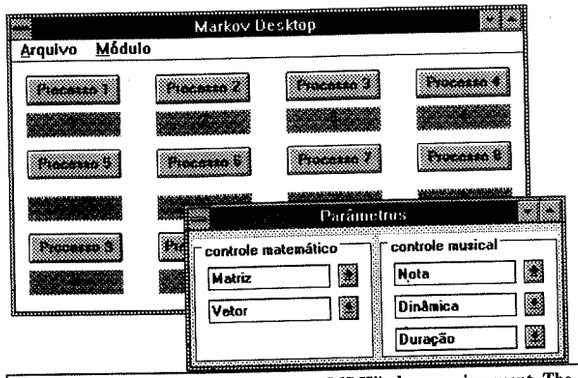

This is the graphic interface of the for a MS-Windows environment. The top window controls the parametric cells and the right window is used to input control parameters.

4. CONCLUSION

In this work we have emphasised the dynamic aspect of the stochastic processes (in particular of the Markov processes) in contrast to the static concept of probability distribution as worked by several authors such as Xenakis (1970), Jones (1981), etc. We have investigated the applications of our method to a macro-structural approach based on the MIDI event representation. From this point in our research, we are going to construct a micro-structural model in which the Markov process will control waveforms or sound cells such as described by Manzolli (1994). Finally, the use of Stochastic Process in composition can provide many ways of helping the composer's choices. If under Boulez (1986) point of view there is a *kernel of darkness* inside each composer and for Cage (1961) *pure chance is ultimately irrational*, we are still searching for a good representation of this complex and immense world that is the compositional systems created by the composer's own imagination.

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THE DEVELOPMENT OF A GESTURE INTERFACES' LABORATORY

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ABSTRACT

This describes the goals of the Laboratório de Interfaces Gestuais (LIGA) at the Interdisciplinary Nucleus for Sound Studies (NICS-UNICAMP). The aim of LIGA is to build MIDI controllers using digital circuits and various transducers, and to create graphic interfaces for interactive compositional purposes. Three prototypes are presented: two new graphic interfaces developed for MS-Windows Environment and a glove interface which uses the movement of the hands and wrists to produce MIDI events.

1. INTRODUCTION

The desire to use gestures to produce music with electronic devices dates from 1919 when an electronic instrument *Theremin* was invented by the Russian scientist Lev Termen. Music was produced when a performer moved his hands in the neighborhood of antennae to control the amplitude and the pitch of two quasi-sinusoidal oscillators (Glinsky, 1992; Boston, 1989).

More recently, the use of computers as musical instruments was referred to by Boulez (1977) in the following terms: *Oscillators, amplifiers, and computers were not invented in order to create music; however, and particularly in the case of the computer, their functions are so easily generalized, so eminently transformable, that there has been a wish to devise different objectives from the direct one: accidental conjunction will create a mutation.*

The development of the MIDI protocol allowed to use the computer as a controller of musical parameters enabling interactions with musician(s) in real time. However, the MIDI digital data stream differs fundamentally from the analogue approach. For example, using a Theremin a musician acts directly in the sound continuum. In opposition, MIDI devices control only a discrete sequence of sound events called MIDI events or messages. Therefore the development of MIDI-based interfaces to operate closer to the sound level is an important Computer Music research issue. The Steim Foundation in Amsterdam, has conducted significant research in this direction and has developed a series of interfaces (Krefeld, 1990). Composers have designed new instruments (Teiltelbaum, 1984; Beck, 1991). A novel approach to musical organization was presented by Orton (1992): a MIDI-based interactive instrument called *MIDIGRID*. Rowe (1993) discusses and illustrates very well the concepts of interaction between musicians and computer, contains a survey on interactive systems and a description of his own *Cypher*.

The seed for the *Laboratório de Interfaces Gestuais* (LIGA) was planted at the Institute of Sonology (1991-92) when I worked in a join project with the Steim Foundation (Manzolli, 1993) developing interactive gloves with Hall effect sensors and mercury switches for the Sensorlab (Cost 1992). I came back to Brazil with those gloves but without the Sensorlab. This new situation left me to create LIGA. A search for solutions to replace the SensorLab and to use other transducers begun. Another goal was to create graphic environment interfaces.

The next sections present a brief description of the research's going on LIGA at this moment. They describe the LIGA's activities elucidating theoretical issues and presenting a brief description of three new interfaces: *LIM, Quadrilátero and Luvas de Pelica.*

2. RESEARCH GOALS

Interaction between musicians is a tool for development of musical ideas in many musical and cultural contexts. In the harmonic cadences of a Jazz section, in the rhythmic patterns of the Indian Tabla, or in the massive rhythmic structure produced by a Brazilian school of samba, the individual ideas are transformed in collective ideas, the sonic context and the musical skills are adjusted to the communal sense of the musical realization and music becomes a synergetic interaction of the participants.

LIGA's main goal is to investigate the possibilities of creating mechanisms to control musical transformations in performance situations. The basic proposals are: a) *to use a performer not only as an interpreter but also as a source for musical development and* b) *to use the computer as musical instrument.* LIGA also intends to humanize the relation between machine and musician, creating means for performers to influence the musical results. These concepts imply seeing the compositional act as an exploration in which the composer, the computer and the performer are entities within an integrated and unified real-time system.

In the first period (1994-95) LIGA efforts were concentrated on software design. Some hardware was developed that produces interesting sonic results using few electronic components. LIGA also forms human resources, as Walter Ohtsuki, working on software design and Renato Meirelles, taking care of the hardware development.

3. GRAPHIC INTERFACES

This section discusses the musical and algorithmic concepts incorporated in two graphic systems called *Laboratório Interativo MIDI and Quadrilátero*. They can be defined as Graphic Instrument Environments wherein the mouse location on the computer screen is used to control musical events during performance. They use these gestures as a real-time generator of MIDI events.

A. Laboratório Interativo MIDI *(LIM)*

LIM explores the MIDI protocol in an innovative way by not sequencing MIDI events linearly thus giving freedom for combining MIDI data in many ways. The mouse movements upon iconic operators or objects (faders and a graphic pad) are stored in an array or track. This information is further treated in various ways to form MIDI messages. Added to LIM are two other devices: *a time function and a modulation procedure*. The time function changes speed of individual tracks making possible to stretch the duration of each recorded event. The modulation uses MIDI input and MIDI feedback to produces complex transformations in the tracks as well. Two modulation coefficients interfere in a track by combining its events with the incoming MIDI data as follows:

$$\text{new-event} = \alpha.\text{MIDI} + (1 - \alpha).\text{old-event} \quad \textit{with } 0 \leq \alpha \leq 1$$

It is surprisingly how large is the number of combinations that LIM is able to generate. The sonic results being complex, this interface produces interesting soundscapes. LIM explores quite all possible MIDI messages using simple graphic devices: a set of six scroll buttons for Program Change, Channel, Note, Velocity and Pitch Bend, a graphic pad, a graphic mixing desk to control the volume of 16 MIDI channels, a small keyboard and two array records each one with three tracks .

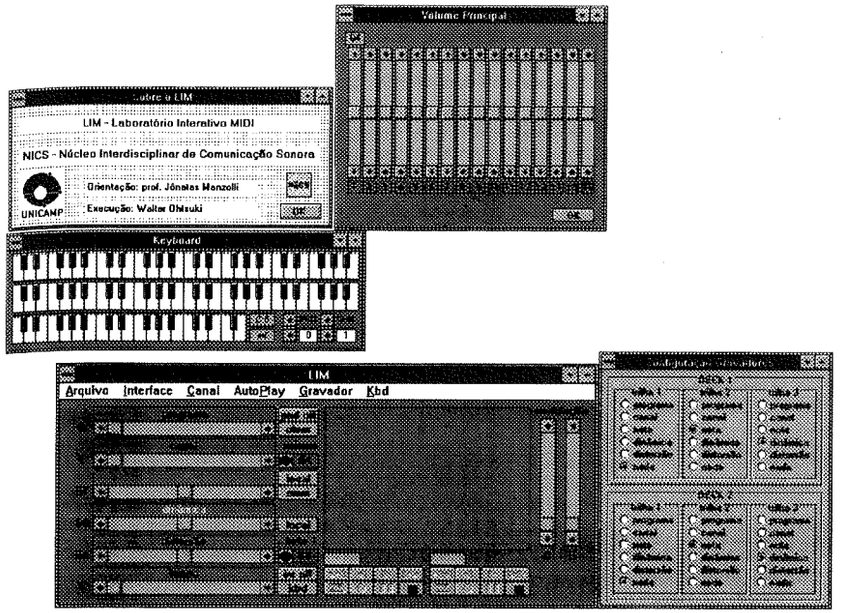

Figure 1.0 - LIM's windows: the presentation form, the mixing desk, the controller keyboard, the control panel and the array record configuration table.

B. Quadrilátero

The genesis of *Quadrilátero* was inspired by the art of painting. This interface differs from LIM by the way the system interprets the mouse's gestures. While LIM uses the mouse to generate MIDI events in several ways, *Quadrilátero* uses the mouse as a graphic brushes transforming the computer screen in a sound canvas.

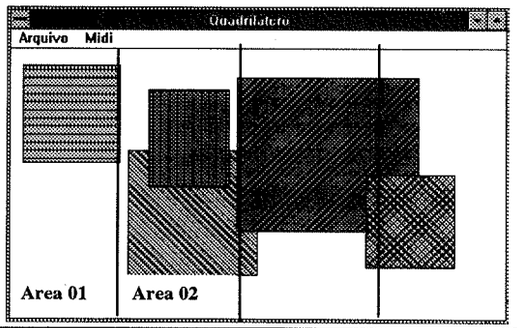

Figure 2.0 - Quadilátero's graphic interface showing the sonic frames divided by vertical lines in four areas of interaction.

The algorithmic approach was to simulate a situation wherein the computer controls a sound environment and the performer produces changes in the soundscape by means of manipulating rhythmic structures, clusters of notes and pitch sequences. The performance and composition processes are integrated in *Quadrilátero*. The musician draws rectangle areas with the mouse and these became sonic frames. Then fills these frames with MIDI data (this can be done by the mouse or by a MIDI controller). After this the sonic canvas is explored with the mouse - its paths upon frames make their contents to be sent to the MIDI port.

A graphic function looks after frame's overlaps. When the performer moves the mouse along the screen it takes care of overlapping data. Take *Figure 2.0* as an example: if the mouse is in *Area 01* the computer plays only one set of events, but if the mouse is in an overlapping sonic frame in *Area 02*, the computer plays two sets of events simultaneously. Using Quadrilátero a musician constructs a space for sonic exploration and can use various rectangle combinations to create different sonic frames overlaps.

4. GLOVE INTERFACE

The expressive potential of the human body, was the starting point for this interface. The project was to draw an explicit line between music and body expression. Music resulting from movement, and dancing to music is seen as the same thing in many different musical cultures; that is, the regular rhythmic movements involved in producing music are regarded as a form of dance. The first device needed here is a sensor/transducer to measure the density of performance actions related to some scale. The information from the sensor produces a control for the gesture output; the system's triggers are a set of these sensors fixed in a pair of gloves. The second device used on *Luvas de Pelica* is a set of mercury switches which create rhythmic patterns produced by the vibrations and movements of the performer's wrists.

The aim of this research was to search for a simple glove interface which could be constructed with few hardware resources. The goal was to develop a very simple controller black box to receive information from non-expensive transducers. In this way, the ideas used on the hardware project were: a) the controller black box is a combination of the Alesis D4 drum module and a very single digital multiplex circuit and b) the transducers used are piezo electric devices and mercury switches.

Luvas de Pelica was developed to produce music by contrasts such as turbulence/calm, loud/soft sounds, high/low densities and silence/sound. The performance is a hand-dance in which gestures interplay sound events and the music happens as a consequence of the action of these movements. These produce pressure changes on the piezo electric transducers and vibrations in the mercury switches. The diagram of the interface's hardware is presented on the next page.

CONCLUSION

Performance with new interfaces, is a musical situation which should be further explored and studied. The point here is not so much the presentation of a new technology in the stage, but rather the understanding of relations between algorithmic real-time generated music and live musicians. The effective integration of computers and performers to provide an appropriate control of real-time sonic events is a goal still to be fully achieved.

The handling of interactive compositional paradigms implies the combining of two opposite concepts in one system: determinacy and indeterminacy. Further the objectivity of a formal approach enables the expression of subjectivity in the transforming of musical materials. The use of improvisation as a way to produce good music, emphasizes an aspect of musical practice which may not have a priority in the West. It would certainly be interesting to see the use of computers developing new ways of human interaction through music.

AbCMus: Uma abordagem para construção musical interativa

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Abstract

Traditional music teaching gives more importance to theoretical aspects and instrument performance than to creation or research. In the way of allowing also to **non-specialist** the experience of ***doing music***, we propose and present **AbCMus** — acronym from Portuguese to **Musical Construction Approach** — a trans-disciplinary approach involving (also but not just) philosophy, psychopedagogy and computer music, where musical knowledge comes from the **interaction** between the non-specialist and his/her musical experimentations — and not just as mental rules —, allowing creativity, curiosity, dance, feeling, self-consciousness, game, re-search. AbCMus also propose the interaction of alternative musical notations, as support for another musical conceptions than the European Erudite. Computational aspects are also presented, as a set of operations to interactive musical knowledge construction and a drag-and-drop user interface proposal.

No ensino tradicional de música há uma ênfase muito maior em aspectos teóricos e técnicos, pouco se oferecendo para o **não-especialista** a experiência do *fazer música*. Como veremos a seguir, este tipo de abordagem envolve concepções de arte, cultura, educação e sociedade fortemente interligadas e inter-relacionadas. O objetivo deste artigo é apresentar a ***Abordagem de Construção Musical***, uma abordagem transdisciplinar alternativa para a pesquisa e o aprendizado musical. Na medida que esta abordagem é uma tentativa de resposta a um problema, comecemos apresentando o problema e, a seguir, o processo de construção desta alternativa

O problema: o ensino tradicional de música

Entende-se aqui como *ensino tradicional de música* aquele majoritariamente realizado nas escolas de 1° e 2° graus, nas faculdades (institutos, universidades) de música e nos conservatórios musicais; e, em especial, nos países de colonização européia. Claro que este ensino não é realizado exatamente da mesma forma em todos estes ambientes e em todos os lugares; mas isto não impede uma análise geral das características mais comuns, talvez mais adequadas a uns ambientes que a outros.

O conhecimento humano envolve as mais diferentes áreas, as mais diferentes culturas, as mais diferentes abordadagens, filosofias, crenças, ideologias. Os currículos escolares são resultado de um processo de seleção destes conteúdos. Na escola, o conhecimento científico é priorizado sobre o artístico, o filosófico, o místico. E a cultura erudita européia é tomada como referencial de anállise das demais culturas. Assim, dentre as várias concepções de música e dentre os diversos estilos musicais, é a música erudita européia (principalmente dos séculos XVI ao XIX) que é usada como referência do que deve ser ensinado. A própria separação entre *música popular* e *música erudita* reflete o preconceito para com outros povos, outras classes sociais, outras épocas, outros ambientes culturais.

O ensino de música se faz de forma independente do ensino de História e Filosofia (da Arte, da Cultura), de Física (acústica), de Eletrônica (construção de equipamentos), de Matemática (séries de Fourier, propor-