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MIDIGRID – A NEW MUSICAL PERFORMANCE AND COMPOSITION SYSTEM

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ABSTRACT

In the last few years – with the invention of MIDI (the Musical Instrument Digital Interface standard) and the development of powerful and relatively cheap home microcomputers (such as the Atari ST) – music technology has become readily available in the home, in education and in music studios. Music software for microcomputers has previously been directed towards ***sequencers*** *(programs which play back music in a structured manner) and* ***score–writers*** *(those which print out music on manuscript paper). MIDIGRID is an innovative program allowing the user to* ***perform live music*** *as well as being, in effect, a compact recording studio. MIDIGRID is adaptable to each person's individual needs, which is why it is particularly accessible to disabled people and is breaking new ground in the field of music therapy and rehabilitation. However , to the non–handicapped musician, it offers a totally new approach to the composition and performance of synthesised music.*

INTRODUCTION

The work described in this paper arises out of current research at the University of York to devise new computer–based musical instruments for use in composition and performance. This work is opening up interesting new concepts in the field of human–computer interface designs.

BACKGROUND – MIDI AND COMPUTERS

The introduction of MIDI – the **M**usical **I**nstrument **D**igital **I**nterface standard – has totally revolutionised the music industry within a few years. It is a serial interface which allows synthesisers, keyboards, computers and sequencers to be connected together in a daisy–chain configuration. Unlike other serial communication standards MIDI defines the data format and transmission speed used in sending note–on, note–off, pitch–bend and control information. The devices connected together in a MIDI system have a defined address or 'channel number' which can be used to direct data to a specific instrument. The provisions of the standard are observed by most of the major instrument manufacturers so that practically all new electronic musical instruments are compatible (to a large extent) with each other.

Many modern microcomputers (such as the Atari ST series) have MIDI interfaces available for them. The flexibility of MIDI makes powerful musical systems and studio recording facilities readily available using equipment obtainable from high–street stores. The very fact that the MIDI standard exists has itself promoted the development of new musical systems. The system described in this paper perhaps falls into this category.

Software for these computer / music applications usually falls somewhere between the following two categories :

a) **SEQUENCERS** : These allow the user to provide the computer with information about what notes to play and when to play them. Subsequently the computer will play the musical sequence back at the desired speed. Some programs permit music to be played in (say from a MIDI keyboard) and then to be played back and adjusted as required.

b) **SCORE – WRITERS** : These programs allow the user to produce a written musical score (either on the screen or in a printed form) suitable for publication or performance.

Some very useful programs combine various aspects of the above two generalised categories as well as adding other functions.

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LIVE PERFORMANCE WITH COMPUTERS ?

Many of those who dislike computer music do so because of the lack of any apparent human element to the pieces.

There are two major components to this :

i) The absence of a focus of attention during a performance. Those attending a live orchestral concert would feel very different to those listening to a *recording* of orchestral music.

ii) The over–mechanical nature of the musical sound produced.

DESIGN ISSUES FOR MIDIGRID

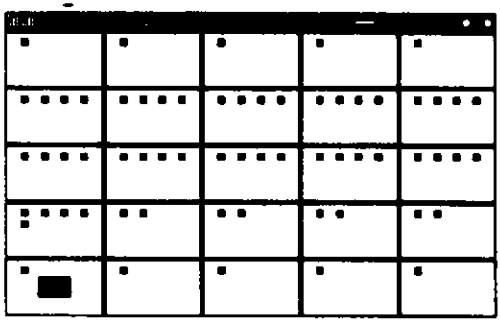
The points identified above provided the focus for the design of MIDIGRID. This was concerned with the investigation and implementation of a novel human–computer interface which would allow the power of the computer to be used in a flexible way in the control of MIDI systems. This was to be done in such a way as to allow live performance with commercial synthesisers, drum machines and related equipment.

In setting these objectives we were aware that we were embarking upon an ambitious programme which had an in–built but interesting dilemma: if we were to design a new musical instrument, perhaps we should not expect users (performers) to be able to perform proficiently until they have had sufficient practice in its use. If this process were to be comparable to that for conventional acoustic instruments, this might take somewhere between five and ten years. On the other hand, it would seem unreasonable to expect the 'training' period for an 'operator' of a new machine with a sophisticated interface to extend over this interval. It would also prove difficult (by definition) to demonstrate the capabilities of the instrument in its early years! We accept that this possibility has to be faced if we are to produce an instrument which has sufficient capability of expression to retain aesthetic interest beyond the initial training period.

AN OVERVIEW OF THE SYSTEM

At this point, it would be useful to outline the functions of the MIDIGRID program in order that some of the concepts discussed in this paper might be more easily understood.

MIDIGRID is based around a grid on the screen – hence the name. The user can choose how many boxes make up the grid and exactly what musical structures will go in each box.



A GRID PATTERN SHOWING NOTES AND CHORDS

The musical sounds are not made by the computer itself, but by the MIDI instrument connected to it. Every external MIDI instrument has a set of timbres (usually 64 or 128 sounds) which can be used by MIDIGRID. The program lets the user choose notes (of any pitch) from these timbres and place them in the boxes on the screen. More than one note may be placed in a box, in which case the box represents a chord (i.e. the notes are played simultaneously). Alternatively, a sequence of notes (a tune) may be placed in one box.

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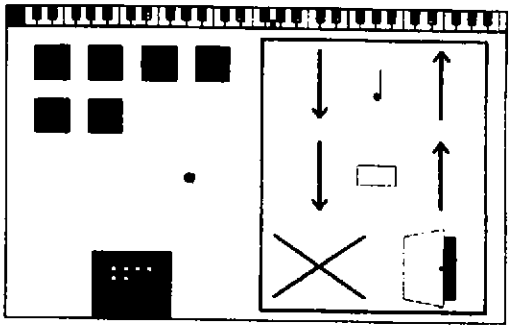
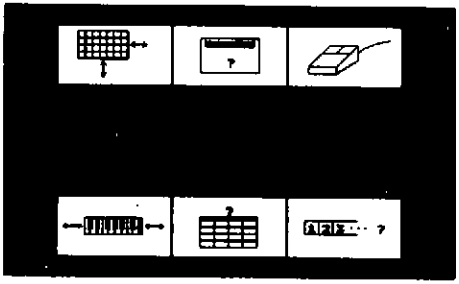
The Atari's *mouse* input operates a cursor on the screen. When this cursor is moved to a box on the screen (and a mouse button is pressed), the contents of that box (note, chord or sequence) are played. It is possible to have more than one sequence playing at any one time and it is also possible to overlay further notes and chords from other boxes as the sequences progress.

MIDIGRID can record what is being played, placing the resulting sequence into a grid box. This sequence can form the basis of a new performance and so on. Anything which can be played on an external MIDI instrument (such as a keyboard) can be recorded into a box and used in the compositional/performance process. Recordings can be made which incorporate previous sequences, thus forming multi-track compositions.



MIDIGRID – NOTE EDITING FACILITIES

Going one stage further, it is possible to *map* any grid box to any key on the external keyboard. This means that it is possible to control notes, chords, small sequences and entire compositions from the keyboard, *in addition to* being able to play the grid with the mouse. This whole process can be recorded, and the result placed in a grid box. The process is only limited in practice by the number of note events which can be handled by the MIDI instrument at any one time. This is a more significant restriction than other factors such as memory size.



Every parameter of the program is definable – from the size and configuration of the grid to the way the mouse responds to movement – and all the information is stored in *patches* (files) which can then be saved on disk (see diagram left). Effectively, this means that on loading a patch, the entire MIDI system as well as the computer system sets itself up in the way it was configured when that patch was created.

UNEXPECTED RESULTS ?

As described above, the contents and size of the grid can be determined by the user. Although there are very few limitations to the combinations of notes, sequences and timbres which can be set up, we have found in practice that careful consideration of the layout can give some interesting insights into new musical possibilities.

It is possible, for instance, to use the entire grid to manipulate the sounds of one timbral type. The organisation of the notes within the grid determines the characteristic of the instrument. The layout could be based for example on arpeggiated structures, block chords, pentatonic and other scales or even on a tune encouraging experimentation with variations.

Alternatively it is possible to designate different areas of the screen to contain different instruments. For example, one area could hold drum sounds while another contains organ chords or perhaps a range of sounds emulating a gamelan orchestra. Other possibilities include the ability to build chord structures with mixed timbres.

Single sounds in the grid give an 'instrumental' feel to the movements of the mouse. However, as the grid begins to contain a greater proportion of sequences and chord structures the user gradually takes on the role of a conductor. With mixed layouts of simple notes and complex structures a possibility exists for a new mode of performance *combining* the traditional roles of conductor and instrumentalist.

These properties can be developed so that the user is able to customise his own instrument to explore new musical idioms. He is no longer constrained by conventional keyboard based patterns of composition. It is possible to have extremely rapid transitions between very rich chord structures for instance. As a performer, the user is positively encouraged to experiment with improvisation.

Many of these possibilities only became apparent during the development of the program, but more than justified our initial objective to take a fresh look at instrument design.

AREAS OF APPLICATION

The design of the instrument has not only opened up new possibilities in experimentation with musical idiom. It has also found application with a variety of different groups of people which equally we did not anticipate at the outset of the project.

Innovative Composition and Performance Techniques

Composers have already begun to write for Midigrid. Several performances have been given in the North of Richard Orton's "Crossover". The piece consists of the interaction between two performers, each of whom has a Midigrid system and a synthesiser. The players have several grid patterns prepared, each of which sets up the sounds needed and acts as a performance instrument. The 'score' for the piece is in fact a series of screen–dumps showing the grid patterns marked with arrows.

The program has proved useful as a general–purpose compositional environment. It can be used simply to record music from a keyboard and then allow the sequences to be manipulated. Equally, it allows experimentation with chord structures and improvisations on note layouts *which would be physically impossible on a keyboard*.

Music for people with Movement Difficulties

The advent of computer technology has already enhanced the lives of a great number of handicapped individuals. Since the invention of the MIDI standard, various groups around the country have been using conventional music programs – adapted to operate by single–switch control – with disabled people. Very good results have been achieved using 'sequencer' packages. Nevertheless, these programs only allow the operator to build up tunes and 'play them back at the touch of a button'. As we described earlier, there is something very de–humanising about a computer which is in control. The missing element is the excitement of live performance.

Most conventional musical instruments require the player to adapt their own movement in order to play successfully. For this reason, many physically disabled people (however musical they may be) are denied the chance of expressing their own musicality.

MIDIGRID offers itself as a musical instrument which can *be adapted to the user's range of movement* (and not the other way round). In addition to this , the contents of the grid can be arranged in such a way as to make it easier for an individual person to achieve a particular musical goal. Disabled musicians have found that they soon learn how to 'customise' the grid to allow them to play the music they want to.

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Uses in Music Therapy

Music Therapy is the application of a whole variety of musical techniques (such as improvisation, playing and listening) in order to help people overcome physical, mental or emotional problems. Providing that somebody has created a set of grid patterns in advance, MIDIGRID can be used as a tool which allows instant access to sound *without any necessary musical knowledge or training.*

For example, a child can move the mouse around and produce anything from peaceful harp sounds to heavy metal or even sound effects such as explosions or jet plane noises. The most important factor is that *they* are in control of the music. The computer is acting purely as a slave. This has allowed children who would never understand the meaning or the concept of the words 'improvise a piece' to do so in a completely natural way.

Midigrid's appeal to children with mental handicaps such as autism has been noted with enthusiasm. The program gives a powerful and immediate sound 'reward' which is related to the movement performed. Thus it can act as a stimulus for further movement, or help to forge the mental link between action and response, in other words to teach 'cause and effect' in a very practical and enjoyable way.

Computer Music in Education

Computers are now a part of the secondary school curriculum and are already established in many school music departments. A certain number of 'musical education' programs exist (that is they teach certain theoretical aspects of music) and of course many sequencers are available. It must be noted that many of the sequencers in schools at present are actually designed for professional music studios. So for some children, they may be too complex to use in the classroom situation.

Midigrid is operated entirely graphically, and as such is very easy to operate. It could possibly form a more gentle way in to the more studio–oriented sequencers. However, its main power lies in its ability to be set up in an almost infinite number of musical configurations.

Each grid pattern can be chosen so that it represents a certain 'style' of music. Children can then experiment with these sound–structures and develop their own musical sequences and chord patterns. The flexibility of the system would enable compositions to be put together and stored instantly on disk. Even children with disabilities could join in the process unhindered.

CONCLUSIONS

This paper, combined with a demonstration of Midigrid, should show clearly how excited we are by the potential of this program to break new ground in the world of computer music. It is an instrument for improvisation, composition and performance, as well as being a sequencer and recording studio with full multi–tracking facilities. Midigrid operates on such simple graphics that it makes professional results easily accessible, not only to trained personnel in music studios, but to anyone with sufficient movement to control the cursor. It has opened up new possibilities in performance and composition, and has proved to be a highly motivating tool for use in therapeutic applications.