1. INTRODUCTION

Imitation is one of the most important occupations of a human being. It begins at birth and continues until one dies, the norm. Continuity and gift for imitation within living things is the key to the emergence of the collective physical environment. It is the starting point for every new development in daily life, in society, in science and in the arts.

Various members of the MIDI-group have been busy for years with the invention of pre-existing sound-concepts by means of the MIDI/KORG system developed by Dr. M. Kaji of the Institute for Sonology, which is highly suitable for just such an application. This research allows one to enter into a much more fundamental way into the existing sound-world.

We would like to make the reader attentive to the fact that this paper makes a general reference to the second edition of 1980 of The Journal of New Music Research (JNMR), which is provided to every attendant at the ICNC 1986.

2. DUPLICATION

2.1 WHAT IS AN EVENT-DUPLICATION?

Our world contains a huge number of sound-events. Within our culture and thus within our experience we have given them names and classifications. Imagine that we pick from these a sound-event with the name: piano tone, played at a particular moment by a particular pianist upon a particular piano.

We still have a unique event on our hands. The sound-event as a whole is a particular event within a particular sound synthesis system (the widest system, the broadest sound-event which ever existed). The sound-event cannot be re-produced after listening is not differentiable from our original than the sound of an event-duplication of our original. We found that this sound-event in series of V0SI1-vectors. If these then are sent to a V0SI1-generator (or a set of generators) then the desired sound-event is produced.

2.2 WHAT IS A CONCEPT-DUPLICATION?

From the point of view of our formalization of sound-event duplication, it is not much more than a sound registration. The sound-event is frozen fact, and thus difficult to manipulate. The parameters which could be controlled cannot be used because they have only a physical or technical interpretation. The sound-event for female is a concept from our digital electronics and has nothing to do with music. Despite this fact this technical parameter is still used as a pitch control. Modern technology is at our disposal but applications of it are often at the level of the old analog studio's. Before one spoke of 'time speed' while now it is the 'time-duplicate'.

In this case then nothing has really changed.

Although our V0SI1-description of the sound-event means an important formalization (and data-reduction) the V0SI1-parameters have not been interpreted musically. They only describe the physical characteristics of the V0SI1-signal. A medical manipulation is thus at this level not possible. Modifying the V0SI1-parameters of our piano duplication (for example in an arbitrary manner does not mean that the derived sound still belongs to the set of piano sounds; harschert sound could just as easily come about. In order to prevent a transformation which leads us out of our concept-field (say: instrument) we have introduced the so-called 'concept-duplication'. This is not a single sound-event but a set of sound-events which have the same

(1) The time-function stated by the V0SI1-model (designed by Dr. K. Hikami) is a transient signal which is built from a series of sine-pulsed each of the same time-duration and with various amplitude. For a detailed description we refer to Keesi (1980a).
characteristics as the set of corresponding original piano sound and the property of being a piano sound and thus belong to the cultural concept 'piano'.

\[ \text{SET OF ORIGINS} \]

belonging to one concept

\[ \text{EVENT-DUPLICATION} \]

CONCEPT-DUPLICATION

\[ \text{VOSIM-VECTORS} \]

SET OF VOSIM-VECTORS

We can now assert that all sounds described by VOSIM-VECTORS from our concept-duplication have certain properties in common. The search for these correspondences between the sounds of a single concept within the borders of the VOSIM-formalization is our problem. We shall endeavours to make clear that the MIND-system offers us an excellent solution to this.

2.3 THE MIND-SYSTEM IN BRIEF

The MIND-system is a control-system which links VOSIM-parameters functionally with each other by means of MIND-functions. These functions can be substituted in the VOSIM-VECTORS and file a sound-class fast in the form of a predicate list. The essence of the MIND-system is that a MIND-system is the starting value of a sound-class.

The MIND-system is the starting value of a sound-class. The MIND-system is the starting value of a sound-class.

\[ \text{MIND-DUPLICATION} \]

\[ \text{SET OF VOSIM-VECTORS} \]

\[ \text{MIND-DESCRIPTION} \]

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2.4 THE MIND-DUPLICATION

The MIND-system gives us the sound after correspondence between the sounds of a concept, namely the MIND-functions. All sounds within the concept are described by the course of values of these functions. The MIND-system offers us to describe our concept-duplication by means of a selection of MIND-functions (concept-duplicator). If we now formulate our general plane sound control, then we can vary the pronomic parameters without the danger that the sounds so formed so not anymore have the property of being 'a piano sound'.

Also puttering with the damping-rate as a pitch control is now definitively out of the way, since we now have the actual pitch vs. the pronomic parameter at our disposal. This shows that the existing neutral concepts can be formalized on the micro-level. This special property of the MIND-language makes it particularly suitable for concept-duplication. We have with this found an extremely powerful description of sound-concepts. A choice from out the MIND-functions inexorably yield a whole sound-fundamentally in what is for us a familiar formal language. We do not need to make the whole sound-sense; but can consider the MIND-duplication as a particular, suitable function-product applied to the VOSIM-parameters. For ease we do not consider here the extensive problem with the MIND-parameters (pronomic parameters within the MIND-system brings in its wake).

(3) The MIND-language seen from a purely syntactical standpoint is a general control language which could be used as a control language for various other apparatus and production systems and other auralistic applications as for example the control of robots in industry. In this series the MIND-system is not specifically the sound synthesis system and could thus embrace many of the existing sound synthesis systems. The special characteristic of the MIND-system which we have used of the conceptually integrated MIND-functions formulated by Wolff (1966).

The MIND-system does not by necessity need to control the VOSIM-system. Other sound generating apparatus can be included in a means of a suitable adaption of the MIND-functions. The determination of the VOSIM-system is that it is musically interpretable in a very wide sense and gives sound which can be controlled with relatively few parameters.

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3.2 ETNOMUSICOLOGICAL APPLICATIONS OF CONCEPT-DUPLICATION

Also in the area of etnomusicology sound-duplication have found a use. Why is a concept-duplication useful in this area? The investigation of sounds in foreign cultures often begins with collecting; in the lab, itself, sound material recorded on tape. This tape material which the researcher shares becomes the raw material used to create a form of music. Shaped by means of sound synthesis, namely the names and concepts rooted in the culture are put into a machine and it is according to these that the tape material should be classified. In other words it is the meaning and interpretation of these physical sound-phenomena which is missing and which could open for the way to understanding correctly the music culture being researched. This so-called meta-information is in many cases difficult to collect due to the enormous communication problems existing between the researcher and the native musicians.

Our interpretation of this ethnomusicological problem is in agreement with the previously defined concept-duplication which is extremely suitable for scientific research. It makes it possible to classify and to formalize the sound material according to clearly-cut concepts. The concept-duplication contains by means of its sounds a large amount of the meta-information.

Although the fact of finding a concept-duplication is in practice common and time consuming (see Jansen/Kaesg, 1980) the final result offers a number of possible advantages which allow for new possibilities:

1. Meta-information: We have already mentioned that the concept-duplication contains the meta-information which is so important.

2. Formalization: The concept-duplication are formalized.

a. By this an enormous amount of confusion can be reduced when communicating about sounds.

b. Formalization gives the possibility for concerning of sound-concepts in a formal way.

Data reduction: With the use of a powerful conceptual system such as the MIN/MUSI-system sound-concepts are completely described. There has already occurred a strong data reduction in the registered material (MIN/MUSI-Description of Music) whereby the redundant information is "filtered out". The material becomes in this clearer and more easily manipulated.

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4. Standardization: frequent use of the same sound leads to a standardization of formant sound description. Just as the writer is accustomed to a standard length (System of Interaction) and we are no longer amazed by Japanese DIN-papers, so one could imagine that a world-wide standard for sound description might be introduced (for example the Prosodic). By this means comparisons of a culture both internally and with other cultures would become possible.

Apart from the possibilities in pure musical research which these advantages offer up they could also be of use in a collaboration between researchers from various other disciplines. One could think of anthropology, sociology, linguistics, phonetics, physics, medical psychology, psychology, etc. In our opinion there are still too many "language barriers" between these disciplines because they could be broken through by means of standardization.

In the long run our research shall become increasingly similar because on the one hand our liberal concept-developments are growing and on the other hand because from out a series of duplications others can be derived. It appears that various concepts from a single culture often show correspondences. We shall give three examples of this:

1. As early as the 1960's Dr. M.Kees stated the hypothesis that there exists a close relation between the speech language and the instrumental sound of a particular culture. (Kees, T., "Die Rolle der Musik, 1967"). This hypothesis has shown itself to be valid in many cases (for example the composition for Kotté and Computer: "Water Par. 3.3)

2. In our investigations into duplicating the sounds of the Central Javanese metalophone "the Ganger", it appeared to be possible to derive via simple rules concepts of other Javanese instruments, for example: "the Gambang" (20-Meers Xylophone) and "the Bonang" (an instrument of the Gamelan).

3. The design of the VOGIM-system is also based upon this hypothesis (VOGIM=voice and instrument, means of two synchronized VOGIM-functions: vowels, glides, and formants are easily synthesized; the format spectrum: W.Kees, 1966)). This is based on the hypothesis why the MIDI/VOGIM-system is so suitable for the description of instrumental sounds.

The above described techniques have only been brought into practice by the MIDI-group. The proposed standardization still lies far from reality. Perhaps more similarity with the MIDI/VOGIM-system could lead to "world-wide" guidelines which might result in the standardization which we have in mind.

For the time present the MIDI-group shall continue to try to extend its concept- utilization library on a basis for scientific research and in particular for artistic applications.

3.3 Artistic Applications of Duplications

A duplication once produced has many possibilities for artistic purposes. To take four of them one can say that a duplication can:

1) give insight into the material with which one is going to work.

2) be manipulated and operated upon once formalized within a sound synthesis system.

3) provide musical ideas and means with which to work when writing for orchestra and computer and building up intricate micro-level relationships between the two.

4) be placed in contexts which are foreign to the original sound-concept.

In what follows below these points shall be considered by means of examples drawn from actual practice.

One effect of duplicating a rich sound concept is that it provides a reference point for further activity especially when producing imaginary sounds of one own which naturally should be no less expressive than sounds used in the past. One can in this way become more familiar with the qualities which are necessary for building up a rich spectrum and duplicating the movements of the micro-structure of an instrument in the hands of a good performer can lead himself to become more critical of his own coming from his instrument. The insight into a traditional instrument may help the one attempting to duplicate it, tend to make one more reverence of the actual properties they display, which leads one to the first point namely of acquiring a clearer awareness of the material sound-wave behavior to be used and of sounds in general. This awareness of the micro-structure is often neglected at conservatories.

For a composer his awareness of his materials plays a fundamental role in producing a composition. By means of duplications it is possible to enter into the heart of a sound which interests one and explore it with internally and
externally. It is thus a stage to learn about the characteristics of a sound world and can be of great help when coming to create one oneself. When for example one duplicates a traditional instrument there is attached by long years of practice a particular set of patterns and rules which belong to the sound-concept and labelled with the corresponding instrument name. In relation to how well-known the instrument duplicate is and thus how familiar to an audience, you set the expectation of certain behavior concerning the sound field. This is source material for all sorts of modifications both practical and course with which the imagination can play.

Once duplicated and 'modified in the language of a sound synthesis system, a duplication is open to possible manipulations and operations corresponding to the system in question. Here the MDIN system. In the MDIN system, as we stated in the first part of the paper, the sound concepts are described by means of MDIN functions whose parameters provide the possibility to operate within the system in question. As an example of this we can consider the speech duplication in the third part of Werner Vogel's composition trilogy: 'Convergences'. Here the concept is a 'male voice simulating a poem by the french poet and inventor Charles Crow'. The voice duplication was submitted to a reproduction operation which lowered the voice far below its normal register giving it an ominous and threatening tone but did not effect the micro-structure of the duplication as it remains for the listener a comprehensible male voice. We are still with the deeply defined Boundaries of the sound-concept. Within the MDIN system we could go further and for example introduce a voice corresponing to the system's own male voice. Offering operations, functional manipulations and modifications in and out of pitch and time-duration for speech could be achieved as well than other forms of speech being not normally associated with them which opens in three dimensions of modification for the composer in which to work.

The ability to produce duplications in a synthesis rich environment for example and computer use is to me possible to assign relationships between sound and the user material not only in the areas of pitch and time but also in the micro-structure. As an example of this we could here another composition by W. Vogel entitled Dialogue for Kendhamp and Computer being a Central-Slavische percussion instrument. First computer driven routine under the radar of sounds producible by the Kendhamp and then modified sound-families were derived from out the duplications which were still manually connected with the instrument. The purpose of this was to be able to give the performer of the Kendhamp such correspondence to patterns from his routines of as well as to the relations between instrument and tape. Because the MDIN-system is able to describe the outer limits of a sound-concept in a very clear way highly sophisticated material can be created which gives the impression of being a known sound-concept yet is bearing an estraying on the risks of as well as to the sound world of the instrument and computer connected bands and can suggest one another in very fascinating ways.

The composition 'La noble et La Bete' by F. Goddean and J. Jaunen makes use of a duplication of a Central-Slavische instrument of the metalophone family called a dagger and a simulation of a woodwind-like instrument. From out the latter much of the material for the composition was derived by making use once more of the possibility of altering the micro-structure after formalization of the concept has taken place. It is also an example of moving away from an original sound that it does neither within or on the border of the original concept but in a totally new concept area. The displacement is so extreme that a sensation field is created although the listener will not easily associate the one with the other. Thus the scale from duplication-concept to the construction of a new synthetic-concept is completed. The genuine duplication on the other hand is not submitted to alteration in its micro-structure but occurs in this imaginary context surrounded by sensory sounds hence its associations lead not at the first to the real world. This is an example of how duplications sound-concept in a foreign environment moving away from the original place behind as act as he receives a new sound.

We have now been with these three examples how it is possible to create a sound-concept which can be sharply defined in the MDIN-system to work within a new three dimensional sound-concept of a concept and then proceed to work outside the concept and build up a new sound based on the original. So in place of the common idea that duplications are a hindrance to the composition we can see that they can expose a new and far reaching concept world and generate many possibilities for the composer and his activities.

4. SOME THOUGHTS FOR THE FUTURE

What has just been described is all at the moment still on the experimental. The future that duplications could be constructed via microphones from out a
series of sound-instances. This would demand a pattern recognition system able to detect the most relevant information needed to describe a sound-concept and which could formulate it within a given sound synthesis system. This means predicator and descriptor families could be produced automatically. We could imagine a pattern recognition system of enormous power such as the one mentioned above and the worldwide standardization of sound-description as spoken of in par.3.2 of this paper. Data bases of the duplication could be constructed containing all available predicators and descriptor libraries representing particular sound-concepts or families of concepts. Users working with the MIDIM-VOSIM-system wherever they might be, say in an office or in a studio, would have access to add themselves to the data bases. For composers this source would be of endless use upon trying to give form to their ideas.

The composer working as we imagine it in the future, works at home and is linked up to data bases. Both systems with which he deals are set up in such a way that he is able to work on all levels (sound-level, concept-level) in an associative way, which is to say in a form to order his ideas and material at the speed of his thoughts. The pattern recognition system will be available, which can analyze and describe any sound he gives to it, and incorporate fragments or intonations coming from his own voice which is picked up by microphone and sent to the system. His system will contain a highly sophisticated editor which allows him to store material immediately and alter and combine the material and provide him with playback of his work whenever and so quickly as he desires (see accompanying figure). Also his work room will be comfortable, relaxing and contain only the bare, necessary equipment which is elegant and unobtrusive. What is more he will be able to walk around in his composing instead of being tied to a chair.

The data bases will form a source from which new concepts can be formed and will be the vital link to the past traditions, the universal card to the cultures route, and provide an unlimited means for development both personal and sociocultural.

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[Translation by P. Goodman]

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MDIM-GROEP VOOR SONYLOGY, UTRECHT
Wasennstraat 7 3584 NR Utrech
the Netherlands

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