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"Confluence of *Techné* and Musical Thought: 3D-Composer, a Software for Micro-Composition"

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Confluence of *techné* and musical thought: 3D-Composer, a software for micro-composition.

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A software called *3D-Composer* was designed as a visualisation tool to assist composers in creating works within a new methodological and conceptual realm. The author brings forth the notion of musical and symbolic notation as an anchor point to model a system representing musical information based on conventional visualisation techniques. The discussion focuses on the initial impetus and methodology to establish a conceptual link between visual elements and their correlated musical output, integrated in a software for musical composition based on geometric transformations. The goal was to create an application, which would allow users to understand the *techné* which links the geometric transformations to the compositional idea. A definition of *micro-composition* is proposed, and principles of projective geometry, group composition and local composition are implemented to model a short melodic motif, which becomes the basis for larger compositions. The technical aspects of the software are outside the scope of this article.

This project explores a pragmatic research method to define a framework for the compositional process, from which a theoretical model could be established with the intention to create a new compositional technique based on the conceptual and technical aspects of the process itself. In this instance, a creative and artistic approach is favoured toward solving problems of technical nature in order to open new paths of inquiry in the study of musical systems. The pragmatic model is in line with the concept of *techné*, where the process of creative development through technology and its dissemination become synonymous (Manning 2006). Theoretical notions were implemented during the design and development phase of the software, but were not the basis for the construction of process. These notions appeared after the conceptualisation phase, and gradually became the backbone of the materialised version of the project.

A major source of inspiration and motivation for this research project included retracing innovative ideas of the early avant-garde period. This intentional anachronous juxtaposition has had a considerable impact on our approach towards creation and composition. There is no justification for this linkage, other than the thought that, perhaps going back to the original ideas of that epoch may suggest new avenues in a different context. To illustrate this, we refer to the doctrine of Neoplasticism, which alludes to creation and innovation as a transformation of material in all its forms. Through modern technique material is transformed, denaturalised. The forms which thereby arise lack the rustic character of antique forms. The style of our age is largely based upon this denaturalisation or transnaturalisation (Jaffe 1967). Conversely, composers have not yet explored all the possibilities of existing tools and methods, yet they continue to propose new ways to create sounds and music. This is not necessarily detrimental to the evolution of musical discourse, but the advantages already offered by available technology are certainly undermined by the speed at which new tools and techniques emerge.

Technology currently allows digital media authors greater flexibility in expressing and communicating artistic ideas. Whilst technology is available to control musical and sonic parameters in real-time, a tool which could represent conceptual information in the form of a visual model would allow more accurate and efficient transmission of the original musical intent. Many systems utilise traditional notation methods to visualise musical information. Two main categories include score typesetting applications for a printed visual representation, and sequencing applications to organise musical information in a pre-determined timeline. In extension to the possibilities offered by instrumental composition techniques, the interest of this project lies in the idea of generating a unique solution where form and style are integrated and undissociable as a new type of structure. A traditionally oriented paradigm is therefore shifted to sound, within the scope of electroacoustic music.

Integrating technology on a conceptual level, does not imply greater stylistic and aesthetic complexity. On the contrary, technology has the function of relocating the potential of creativity to a different conceptual realm. This relatively new situation has a direct impact on the ability to convey eclectic musical ideas and suddenly many more creative options are available. Again, effectiveness of the musical message is not related to the complexity of the concept itself. This relies on the context, the aesthetics and the function of the technology involved. From the standpoint of innovation, the ideas resulting from the use of technology are to be supported by substantial arguments to justify their novelty, as an attempt to merge musical developments with the technological (Landy 1999). The technological is inherently a display of knowledge from within, its significance is particularly important in a dynamic audiovisual and multimedia context. One question emerges, does innovative use of technology rime with creative impetus, or is innovation solely defined by creating new technology?

In order to construct a new tool to manipulate musical data, new methods and techniques offered by computer music technology, interactive music systems and digital audio and multimedia software were considered to build a reliable and expandable framework allowing the composer to study different aspects of musical creation. To demonstrate this, we delineate the working canvas within specific notions of conceptual space (see Merlier 2006). In his recent taxonomy of space in electroacoustic music, Bertrand Merlier describes the notion of space as multiple realities depending on the context involved. In his view, space can refer to physical phenomena, psychoacoustic phenomena, musical ideas, artistic concepts, aesthetics, and sometimes, even methods or tools of performance. As a result, space can take several meanings depending on context. This opens an array of possibilities with respect to the angle taken in creating a musical

work, be it instrumental, electroacoustic, multimedia, interactive, etc… During this project, notions of space were interpreted within the scope of a personal compositional direction in order to study different aspects of musical creation. Some aspects include the representation of musical elements, their structure and generative capacity in computer-assisted-composition.

Confrontation with the machine is a normal preoccupation for contemporary artists. It is therefore imperative to analyse the fundamental relationship with the *instrumentarium* in order to appreciate the entire expression palette and its broadcasting potential. Composers in particular, are faced with the challenges of rapidly evolving computer and information technologies, a key factor which has undoubtedly contributed to the choice of strategies during the formalisation phase of the software 3D-Composer. As new programming techniques and systems emerged during the initial phase, it was crucial to keep research and compositional objectives aligned, regardless of which working platform was available. I refer here to progress, encompassing art and technique, and bring forth a quote by Boulez: 'Today's means of progress lies in the use of machines! It alone allows for a real extension of musical thought to include all components of the sound world' (Boulez 1957).

The contextualisation of ideas in the realm of artistic and scientific activity is perhaps the best approach to generate a novel solution for a unique interpretation of a musical phenomenon, where form and process are integrated and un-dissociable. Influenced by Guerino Mazzola's broad classification of musical activity established to understand why certain conceptual mechanisms or definitions are built (Mazzola 2002), a scheme was established to lay the basis for a methodology of engineering an effective computer music system. This approach is essential to keep systems reliable and manageable, and to deepen our understanding of the capabilities and limitations of a computational account for music (Balaban 1996). In this context, one can establish three elements characterising computer music systems as a manifestation of musical activity: innovation, representation and communication.

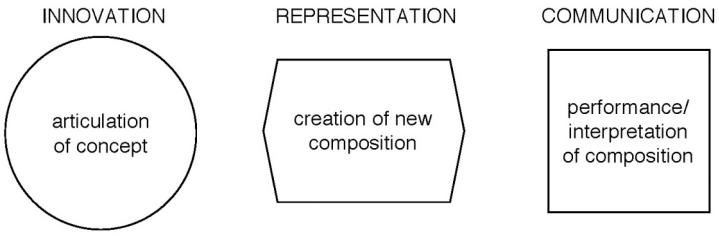

Figure 1. Manifestation of compositional activity.

Let us describe the above elements with the following reinterpretations in a technologically oriented composition situation: *innovation* refers to new ways of expressing musical ideas in a dynamically evolving technological environment, and involves the articulation of concepts and processes which establish a new compositional framework.

In order to create a conceptual link with the evolution of musical notation we seek to extend the meaning of representation for computer music systems. The following definition implies that representation may also involve electro-acoustic instruments or other technological components such as a computer monitor to describe musical phenomena in extension to, or excluding a musical score. *Representation* is the perceivable manifestation of the form, structure and conceptual nature of a musical phenomenon conveyed through a descriptive medium such as visualisation or sonification.

In recent times there has been an evolutionary change, from previously confined notions of communication reduced to the deconstruction of the meaning itself, to an interest in the technological processes involved in communicating meaningful information. In addition to analysing the semantic value of the message, it is also necessary to take into account the communication medium and the transmission methods involved. Within compositional activity, *communication* involves two primary functions: performance and interpretation. They are described as follows: *performance* refers to the act of materialising and communicating conceptual information destined to be perceived as expressing some form of musical meaning. *Interpretation* refers to the act of processing musical information with the aim of retrieving its expressive content and conceptual meaning within a defined social and cultural context.

Recent advances in electroacoustic and computer music have introduced many concepts from other disciplines. In his remarks on algorithmic composition, Martin Supper divides the selection or construction of algorithms for musical applications into three categories: 1. modelling traditional, non-algorithmic compositional procedures; 2. modelling new, original compositional procedures, different from those known before; 3. selecting algorithms from extra-musical disciplines (Supper 2001). This project situates itself at the junction of these three categories. The intent is to model a new compositional procedure different from previous examples dealing with geometric properties of music. Although the relationship between geometry and music have been discussed for several centuries now, the motivation here is to propose a new construction for an algorithm or compositional process, aided by the computer to integrate extra-musical elements (3D visualisation, projective geometry, graph theory...).

Stochastic methods are well known applications of mathematics to create dynamically evolving musical structures, it would also be interesting to determine how varying degrees of translation, rotation or scaling would affect musical structures. This leads to think that many aspects of geometry are yet to be interpreted in other fields of activity, supported by more relevant technology enabling a more accurate rendering of conceptual ideas, especially in computer

music. *'Imagine the projection of a geometrical figure on a plane, with both figure and plane moving in space, each with its own arbitrary and varying speeds of translation and rotation. The immediate form of the projection is determined by the relative orientation between figure and the plane. By allowing both the figure and the plane to have motions of their own, a highly complex and seemingly unpredictable image will result. Further variations are possible by having the form of the geometrical figure vary as well as the speeds'* (Varese 1953).

As mentioned by mathematical theorist Robert Osserman, geometry lived through a serious decline relative to other branches in the middle third of the twentieth century. 'I would predict that with no effort on any of our parts, we will witness a rebirth of geometry in the coming years, as the pendulum swings back from the extreme devotion to structure, abstraction, and generality' (Osserman 1981). Certain transformations are not possible with traditional staff notation, and the introduction of computer technology is paramount in this context. The challenge involves conveying abstract musical information in a different form of visual representation. In his article entitled Translation – Rotation, Mauricio Kagel was concerned with the presentation and design of musical passages by geometrical means. 'Naturally, technical process must be found which can provide an insight into the investigation of the function and effect of translating and rotating' (Kagel 1964).

Here, I propose a definition for *micro-composition*, which is essentially a pointillist interpretation of musical events such as group composition and local composition, with the difference that the values of a numerical sequence are not only permutated to generate new sequences, as is the case with most serial methods, but are also transformed and rotated as a whole to generate new musical material. A *micro-composition* therefore consists of a range of ordered values called nodes representing real numbers, which can be mathematically altered to generate new musical material solely based on that original set of values.

Derived from the aforementioned formal and methodic approaches, 3D-Composer was created to map values from a three dimensional space onto MIDI note numbers to explore new musical textures and generate organically evolving motivic structures. Such a system would provide compositional material and open a vast array of possibilities in a non-arbitrary way. At a later stage, a purely geometric approach could be extended toward a wider analytical scope, to develop a theoretical framework for the intrinsic properties of *micro-composition*. The proposed system is an attempt at recreating and reorganising musical elements from the onset of musical creativity, with a particular emphasis on the visual organisation of musical structures. The compositional process is therefore perfectly integrated in the symbolic representation of the musical idea, which implies in this particular case, that the musical idea and the derived process are inter-dependant. This software is therefore devised as a communication tool for the purpose of musical development based on the pre-established conceptual notion of innovation, representation and communication.

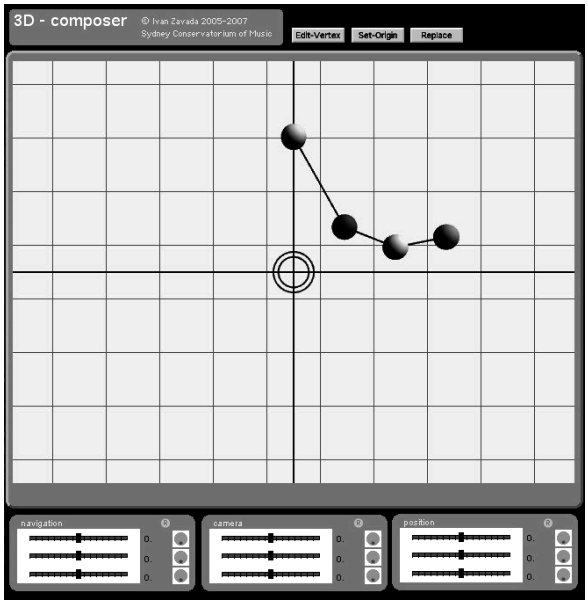

Figure 2. Graphic user interface for the 3D-Composer application.

The user interface was designed in the graphical programming environment Max/MSP/Jitter (see Figure 2). The choice and layout of user controls allows a fluid reorganisation of musical elements in the Cartesian coordinate system. The main window displays the *micro-composition* denoted by an arbitrary number of nodes (spheres) linked to each other by line segments. Control panels facilitate geometric transformations and navigation in 3D space to analyse the structure of the *micro-composition* and visualise elements from various camera positions and perspectives. The musical structure is independent of the time factor, not taken into account in the current prototype. The reason is twofold. Firstly, whilst the manipulation of a *micro-composition* generates musical material over time, the time component is not displayed linearly. That is to dissociate the musical elements from their conventional horizontal time representation. Instead, the

focus is on the geometric transformations in the *x-y-z* axes creating countless melodic contours based on varying rotation speeds and translations to generate new musical forms. Secondly, time structures can be derived from the intrinsic elements of the *micro-composition*, such as the tangent/slope from one node to the next, which can be mapped to a predetermined set of durations. Alternatively, the rotation gradient of the structure can be mapped to a time dependant variable, thus generating rhythmic variations over time. In this version of the prototype, meter and rhythm are dealt with separately with consideration of a desired aesthetic or musical genre.

Variations include transposition, compression and expansion on the vertical axes acting upon pitch. The level of indeterminacy caused by rotation opens new avenues toward non-tonal harmonies. The composer takes part in the creative process by imposing flexible limitations on the structures yielding a 'geometric mode' rather than a strictly serialist or stochastic mode. Structure and form are engendered by the original choice of *micro-composition*. The level of consonance/dissonance varies according to the shape of the *micro-composition*, the more constrained the shape, the more dissonant it will sound, particularly if applied to micro-intervals. If mapped onto sounds or a series of sound objects, the *micro-composition* will generate a variety of melodico-rhythmic and textural material. First, and foremost, the key aspect of the application lies in the capacity to constantly update and interact with displayed visual information.

The software developed herewith addresses two fundamental questions for the construction of a new musical aesthetic. The first is to transcend the conventional tonal system (representation), and the second is to integrate electronic and computer means in the performance and transmission of that new aesthetic (innovation and communication). This dual function is perhaps derived from the post-serialist preoccupation to extend modernism whilst preserving a transcendental link with tradition, but the intention of this transformational system is not to re-create or re-combine the ideas of previous composers, rather, the intention is to retrieve and retain important influential ideas of the avant-garde as a good-fit model to construct a methodology to compose new works.

The technical challenges associated with innovation may sometimes exceed the capacity to produce integrated compositional systems, enabling several techniques to be combined within the same technological framework. Exploring the boundaries of creativity in a defined context may establish grounds for a more adaptable and ubiquitous solution to deal with complexity in the conceptual realm. Accordingly, the respective roles of the composer and electronic music practitioner are essential to develop a methodology aimed at furthering digital artistic expression. Interaction between composer and the technological remains an important aspect for the ramification of compositional techniques. As a result, it can be stated that beside the actual technology, the evolution rate of technology also has an unprecedented influence on the exploration of musical ideas. This project epitomises an original compositional and multimediatic approach within a dynamic creative context reliant on quickly evolving technological frameworks.

References:

Balaban, M. The Music Structures Approach to Knowledge Representation for Music Processing. Computer Music Journal, 20(2):96–111, 1996.
Landy, L. Reviewing the musicology of electroacoustic music: a plea for greater triangulation. Organised Sound, 4(1):61–70, 1999.
Lewin, D. Some Compositional Uses of Projective Geometry. Perspectives of New Music, 42(2), Summer 2004.
Kagel, M. Translation-Rotation, Die Reihe, Vol. 7, 1964.
MacDonald, M. Varèse : astronomer in sound. Kahn & Averill, London, UK, 2003.
Manning, P. The significance of techné in understanding the art and practice of electroacoustic composition. Organised Sound, 11(1):81–90, 2006.
Mazzola, G. The Topos of Music: Geometric Logic of Concepts, Theory and Performance. Birkhäuser Verlag, Basel, Switzerland, 2002.
Osserman, R. Strucure vs. Substance: The Fall and Rise of Geometry. The Two-Year College Mathematical Journal, 12(4), 1981.
Supper, M. A Few Remarks on Algorithmic Composition. Computer Music Journal, 25(1):48–53, 2001.