

# ON VISUALIZING SOUNDS: NEW TOOLS TO SUPPORT CREATIVITY IN VIRTUAL ARCHITECTURAL DESIGN

By:

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## **Key Words:**

Architectural design, music, virtual architecture, digital tools.

*“The Architect should be equipped with the knowledge of many branches of study and varied kinds of learning, for in the architectural judgment all of the work of other arts is brought into test...therefore let our architects be educated, skillful with the pencil, instructed in geometry, knowledgeable in history, follow the philosophers with attention, understand music... and many kinds of learning.”*

*Marcos Vitruvius Pollio*

## **ABSTRACT:**

This paper brings together two widely divergent and seemingly incompatible fields, and yet maybe very closely inter-related; Architecture and Music. The paper deals with the possible translation of music into visual arts, then proceeds with addressing the possibility of translating music into architectural works.

The study represents drawings, diagrams, and models of the translation of music into art form and then into architectural form. A case study is presented to show the outcome of this translation.

By bringing forward the varied mutations of visual sound, the study points out towards the numerous ways computer-generated architecture and music are mutating and challenging one another, and looks to a future of further reinvention.

## ملخص البحث

تجمع هذه الورقة البحثية ما بين مجالين وإن بدا مختلفان إلا إنهما يشتركان معاً في الكثير من المفردات والمصطلحات والقواعد، وإن اختلفت أساليب التعبير أو تباينت مجالات الاستعمال، ألا وهما العمارة و الموسيقى.

ويتناول البحث عملية الترجمة من مجال فنى معين لمجال آخر كمدخل لعمليات التصميم الإبداعي، فيقدم البحث منهجية للترجمة من الموسيقى إلى الرسم ثم من الموسيقى إلى العمارة. وذلك بهدف استكشاف وسائل جديدة لدعم عمليات التصميم المعماري الإبداعي في مجال العمارة التخيلية. فيقدم البحث دراسة حالة أمكن من خلالها ترجمة قطعة موسيقية إلى مجموعة من الأعمال الفنية ثم تمت ترجمتها إلى مجموعة من الأعمال المعمارية، مشيراً بذلك إلى مختلف التحديات التي فرضها مجال العمارة والموسيقى على بعضهما البعض من خلال استخدام الحاسب الآلي. ثم تتعرض الورقة البحثية بعد ذلك لمستقبل هذا المدخل فاتحةً بذلك آفاقاً جديدة لمزيد من البحث والاستكشاف في نفس هذا المجال.

### **1. THE PAPER'S INTENT:**

Any one who attempts to relate architecture and music at the beginning of the third millennium must first ask; what music? and, what architecture? The topic of this relationship may seem to be an ancient one, however, any attempt to address the subject without acknowledging and accounting for the changes that have occurred and are still occurring is sure to be full of unintended but inevitable erroneous resonances.

This paper addresses architecture and music as grounds for the present processes for the making of the future. The main interest is not in the stable core of the known, but rather in the turbulent edge of the unknown or the barely conceivable. The paper's intent is to address and explore the possibility of finding a methodology to enhance creativity in virtual architectural design.

The study addresses the exploration and design of transitions between different domains into and between virtual environments. Of special interest to this study, will be the transition from music into art and architecture in cyberspace.

### **2. INTRODUCTION:**

In between any two languages, media or domains, there exists a membrane through which meaning can move when translating from one discipline to the other. By membrane, I mean a thin pliable layer that

connects two things and is, in this paper, the middle position of: music and architecture in what Novak (1990) calls “**archi-music**”, and the middle position of: art and architecture in what we shall term: “**art-itecture**”.

Louis Khan once described great architecture as that which starts with the immeasurable, then proceeds with the measurable and then returns to the immeasurable. He was describing a process by which the spark of genius in a concept or an idea is carried by way of investigation, drawing and construction into a finished piece of architecture. In this paper, starting the immeasurable is the beginning to explore the thin membrane connecting music, art and architecture. Although music, art and architecture have different phenomenal presences, the underlying organization of their structures is similar.

The aim of this investigation is to support creativity in virtual architectural design by exploring *translation* as a new design tool; translation here is defined as rendering of the same ideas in a different language from the original by searching for a methodology that may lead to creative means of expression for the new term; *art-itecture*.

### **3. THOUGHTS ABOUT CREATIVE DESIGN:**

According to Gero and Maher (1992), creative processes in computer-aided design are identified as those that introduce new design variables into the design process. Thus, in creative design, the designer operates within a changing state space of possible designs; a state space which increases in size with the introduction of each new variable. Processes of this kind are called “creative design processes”. Such processes do not guarantee that the artifact is judged to be creative; rather they have the potential to support the design of creative artifacts. Translation from music to art and/or architecture (whether it is the process itself, or its product) is seen to be the newly introduced variable in the design process.

### **4. THOUGHTS ABOUT ARCHITECTURE: Physical Vs. Virtual:**

According to Ching (1979), architecture is defined as the making of place by the ordering and definition of meaningful space, as developed in response to a need program. According to Campbell (1994); it is also defined as the expression of society or culture in spatial, experiential form. Both of these definitions define architecture as a concept or idea which has both; physical and virtual expression.

Physical architecture is the embodiment and expression of societal values in physical form (like bricks and concrete). We witness physical architecture as buildings, parks, plazas, cities and landscapes.

Like physical architecture, virtual architecture needs to be designed. Virtual architecture is that which embodies and expresses the society in electronic form, with polygons, vectors, and texture maps. According to Campbell (1996), virtual architecture is a spatial expression of society liberated from the bonds of the physical universe and given new life in its freedom from physical constraints.

Lacking physicality, virtual architecture does not exist on a geographical site as traditionally understood, but it is rather accessible via *computers* and *human-interface technology*, i.e., it is releasing itself from its physical boundaries, as well as from substance and matter.

Architecture will have to come to terms with an electronic virtual society. The virtual communities will have needs as the communities that exist in the physical worlds, but they will expect more, as they have neither physical nor geographical constraints, they will have higher expectations and different demands for their architecture. An entirely new realm of design will develop as a sister profession to architecture, that of virtual architecture.

## **5. THOUGHTS ABOUT MUSIC AND ARCHITECTURE:**

Falling back to the root of each art, there is the eye and the ear. The eye and the ear resemble each other in function of their parts resulting in the perception of analogous properties of matter. The eye lends itself to a visual field; the ear to an aural field. On the other hand, architecture represents the art of design in space; music represents the art of design in time. Nature continually manifests motion in space, or motion and space bound together as one, it is life. The properties of space and time are inseparable. Without time and space, matter is inconceivable; it is a dead thing. Space gives form and proportion, time supplies it with life and measure.

The analogies drawn between music and architecture have historically generated multiple comparisons along different channels of interaction; rhythm, proportion, harmony and others. The transfer of ideas from one art to the other could occur through channels not primary to either.

In order to look further into transposition along other lines, we may think of architecture and music as two unknowns in a single equation.

$$\boxed{\text{Music}} \quad \frac{\text{material X sound}}{\text{time}} = \frac{\text{material X light}}{\text{space}} \quad \boxed{\text{Architecture}}$$

Where music has a materiality in instrumentation and sound, architecture attempts an analogue in space and light.

Now we stand at the dawn of an era that will witness the *release of architecture from matter*. The intuition that allows us to consider architecture as “frozen music” or music as “frozen architecture” comes from our understanding that, in its very essence, architecture exceeds our vision of the building, as music exceeds our perception of sound. Architecture is the physical feeling of a space; music is the emotional feeling of a space. The translation from one art to the other is neither purely musical nor architectural, but a hybrid that falls between the two disciplines.

Computers will act as the bridge that will connect us to the intimate structures of the two arts for the first time. In data worlds, or in cyberspace; architecture, art and music are bonded, even fused into new disciplines; “*archi-music*” and “*art-itecture*”.

## 6. THE METHODOLOGY:

How is arti-ecture created in cyberspace or in dataworld?

The musical notes, as well as the rainbow colors consist of 7 main notes and colors respectively.

The following table (1) shows the color representation and translation of the musical notes into colors.

Musical Note	Do / C	Re / D	Mi / E	Fa / F	Sol / G	La / A	Si / B
Color	Red	Orange	Yellow	Green	Blue	Indigo	Violet

Table (1): The translation of musical notes into colors

The production here is applied by replacing all the musical notes by their corresponding colors. In addition, a graphical grid is constructed whose basic module is a 2x1 vertical rectangle.

The following table (2) shows the translation of the musical symbols into spaces or areas:















Musical Symbol	Ronde	Blanche	Noire	Croche	Double Croche	Triple Croche	Quatriple Croche
Duration	Whole note	½ note	¼ note	1/8 note	1/16 note	1/32 note	1/64 note
Symbol's Shape							
Area	 x8	 x4	 x2		 /2	 /3	 /4

Table (2): The translation of musical notes into spaces or areas

The smallest musical symbol in the chosen piece of music (the one having the shortest duration), is represented by one vertical rectangle (which is considered the smallest module).

The process must start by constructing the grid, then all its cells are colored according to the musical score. The number of rectangles responds to the musical symbols and their assigned time period. This is the first step, at the end of which the base map is created. Within the computer's memory, reside different algorithms whose running depends solely on the designer's vision or the system's user. These algorithms are simple programs or routines that are found in packages like Adobe PhotoShop, 3D Studio, AutoCAD, Form-Z and I-Vector. Figure (3) shows the musical score, and the base map, translating the musical piece into colors and areas. While figure (4) represents different artistic themes based on the same musical score after running other algorithms.

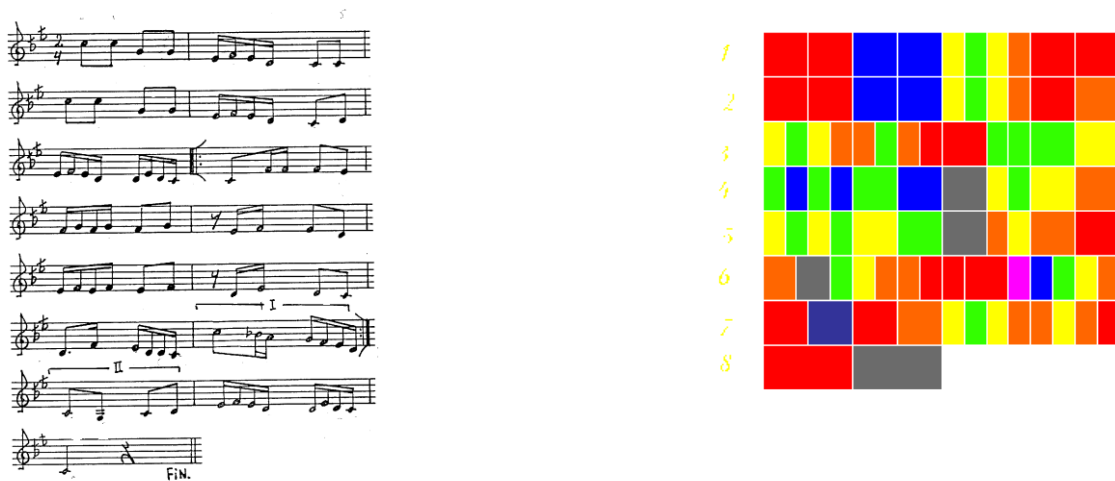


Fig. (3): The musical score and its translated base map

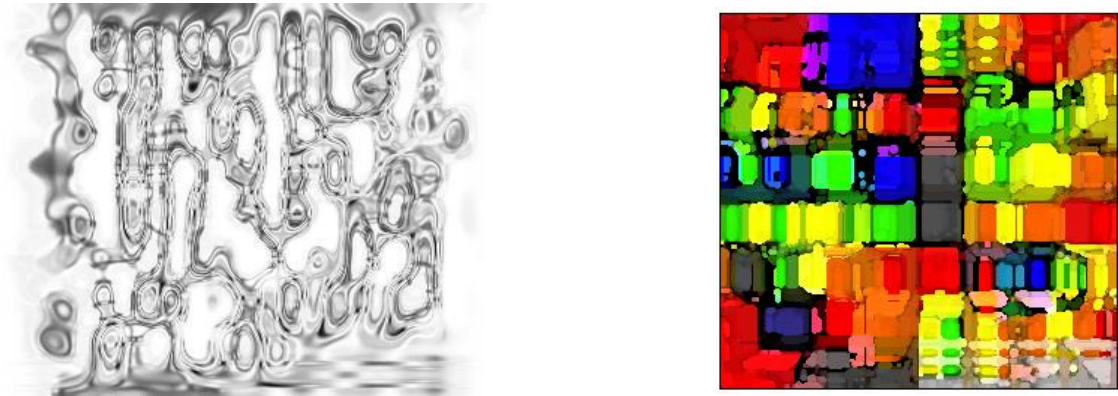


Fig. (4): Different artistic variations on the same theme (same musical score)

The base map produced this way is by no means treated as a final product, i.e., it is not understood as constituting the appearance of the final work or artifact. Rather it is seen as variations in parameter space or the foundation of every coming form or design that affects the perceivable object indirectly, by controlling the behavior of its visible and audible attributes.

Once the base map is generated, it undergoes different mutations according to the different algorithms used. The way these algorithms are accessed or traversed is never the same, not among different designers, nor the same designer adopts even the same trajectory each time.

The outcome of *Paint* programs differs than the outcome of *Vector* programs. However, both techniques; using pixels and vectors may be used alternatively by scanning, vectorizing, screen capturing or by direct input or computation. The various algorithms are used to transform the product into another product form; they extract layers of information in various forms; points, lines, planes, solids and so on. Figure (5) shows some mutations upon the base map after running special vectorizing algorithms.

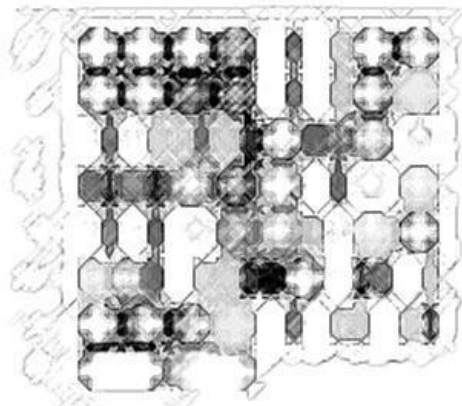


Fig.(5): The base map after applying special algorithms

The logic by which each layer is extracted may differ, and yet, because the variations are controlled by a relatively small set of composed algorithms, the results may maintain essential elements of the original form. The extracted layers in turn, become input to other processes that bring them closer to the desired final form.

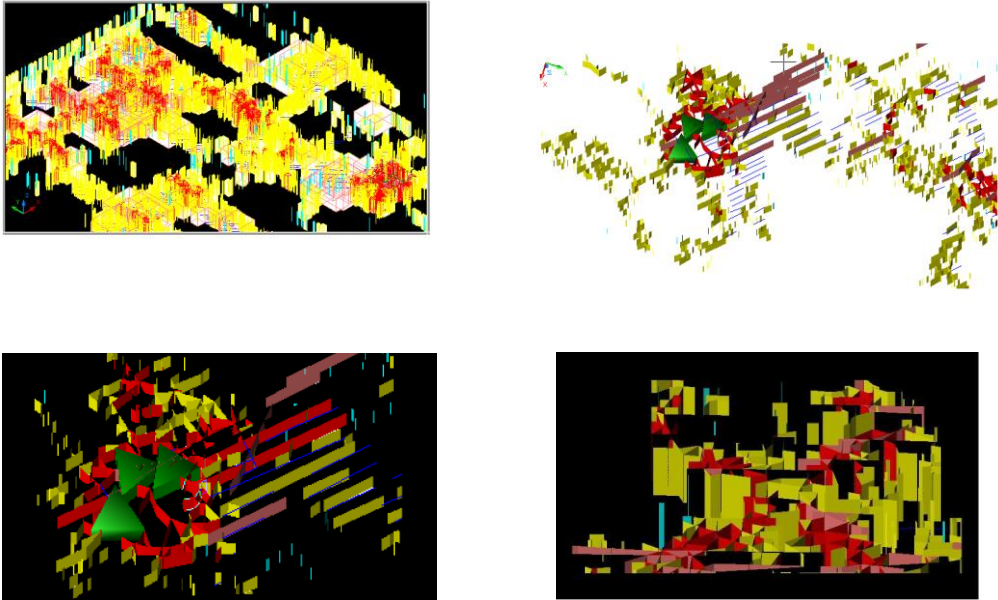


Fig.(6): Different architectural products of the same base map according to different processes

The subcomponents of the result of such processes are then taken to be operands to other processes or set of operations. These processes may be of the familiar type of operations like addition, subtraction, union, multiplication, mirroring and so on. Figure (6) shows different variations of the base map on the same theme producing different architectural designs.

To a great extent, what ensures the strength of the work is not so much the utilitarian logic of its steps, but rather the depth of the process, the number of qualitative kinds of operations that the original data set has undergone.

## 7. DISCUSSION:

As boundaries between different disciplines collapse, new channels suggesting thought and development open up. Collapsed boundaries open crossroads and galleries of connection to support creative virtual



architectural design processes to meet the challenges of the dynamic condition of the twenty first century. Analyzing music as an approach to create artistic or architectural forms is only one way of confronting pressures toward autonomy of architecture.

The way this virtual architecture is achieved relies heavily on the different processes it undergoes, it is seen as if the different algorithms consist of a series of interconnected cyberspace nodes, each node is a world unto itself, but each node may be connected to other nodes forming a fully connected lattice or matrix. As a work, it is non-hierarchical and inherently open-ended. A designer navigating through this matrix is free to explore a series of landscapes and to discover their hidden features. It is unlikely that anyone will ever exhaust the variety of the algorithmic wonders that may be encountered, since they are not only related to the logic of their programs, but also to the unforeseeable circumstances and patterns of each designer's traverse through the different nodes of the matrix.

While there are countless examples of physical architecture which have been designed and built all over the world, there are far few examples of virtual architecture due to the relative youth of electronic media and computer and communication technology. Nonetheless, the design of virtual spaces is still an architectural exploration. According to Novak (1990), by placing the human within the information space, it is an architectural problem, but beyond this, cyberspace has architecture of its own, and further more, it can contain architecture.

However, physical architecture is designed and built to give meaningful places in which society can inhabit and interact. If architecture did not perform this function, it would exist only as sculpture in its own universe. Architectural places are created in the context of the geographical limitations of the physical sites, approached from other spaces and places. A virtual world without a geographical context and a traditional way of approaching the site, exists in the context of abstract and infinite space. Attempts must still be made to create meaningful places in this limitless space.

## **8. CONCLUSIONS AND FUTURE STUDIES:**

This study has presented a new design tool that helps in supporting creativity in virtual architectural design. Translation from one media to another using manual methods and digital technology together has proved

to be promising when dealing with virtual architectures or the architecture of cyberspace.

The current study has demonstrated the visualization of sound in art and architecture coining a new term: *art-itecture*.

Future studies are hoped to address the relationship between these same media but the other way around; i.e., *the hearing of spaces, masses, colors, textures and volumes*. Future explorations shall clearly demonstrate the continuing fertility of the challenges music and architecture issues one another.

In both cases, acoustic and visual, it is envisioned that there is an instance at which the essence of the control over an artifact is becoming finer than the essence of the concepts with which such artifacts are discussed. It may simply be stated that the grain of architecture is becoming finer than the grain of current architectural theory and practice.

With advances in digital technologies, *form* and *space* have yet to be explored thoroughly. Conventional architectural theories and practices have little to give in this domain. Like obsolete theories of music, they simply cannot address the currently available range of possibilities, let alone contend with what the future will bring.

This new technology is providing great challenges for both; architecture and the architect. Architecture's greatest challenge will be *its release from matter*, while the architect's greatest challenge will be *housing the mind, not only the body*.

For better or worse, computing is changing the field of architecture and will continue to do so. As academics, our best role is to seek out those changes or create them, to challenge them or foster them, and to try to make those changes which are inevitable, more interesting and productive.

## 9. REFERENCES:

### **Ching, Francis D. K.:**

*"Architecture: Form, Space & Order."* Van Nostrand Reinhold Company. N.Y. 1979

### **Campbell, Dace A.:**

*"Towards Virtual Architecture."* Technical Report. Human Interface Technology Laboratory. University of Washington. Seattle, WA 1994

**Campbell, Dace A.:**

*“Design in Virtual Environments Using Architectural Metaphor.”*  
Thesis Proposal. Human Interface Technology Laboratory.  
University of Washington. Seattle, WA 1996

**Gero, John S. and Maher, Mary Lou:**

Mutation and Analogy to support Creativity in Computer-Aided Design. In Gerhard Schmitt’s edition: *“CAAD Futures ’91, International Conference for Computer-Aided Architectural Design”*. Vieweg Publishers. Wiesbaden, Germany, 1992

**Novak, Marcus:**

*“Trans Terra Form: Liquid Architectures and the Loss of Inscription”*  
<http://www.t0.or.at/~krcf/nlonline/nonMarcos.html>  
(Accessed January 2001)

*“Liquid Architectures in Cyberspace.”* Cyberspace: First Steps.  
Cambridge, MA: MIT Press, 1990