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UNDERSTANDING VISUAL MUSIC 2015 SYMPOSIUM

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EDITORIAL
Welcome to Understanding Visual Music – UVM 2015!

We are happy to have you here in Brasilia. This is the third edition of the UVM conference, after Montreal in 2011 and Buenos Aires in 2013.

UVM was founded with the spirit of sharing knowledge and discuss the multiple perspectives around a diversity of areas comprehended by what we call VISUAL MUSIC. Each edition has been approaching the subject including different components. On top of a wide range of topics addressed on paper presentations, panels and concerts with pieces created for fixed-media, in Montreal we had a live visual music show closing the conference, including eight complex real-time set ups offering from what we could expect from visual music to works exploring the limits of what we understand of it. In Buenos Aires, the conference was closing with a full-dome show in the city’s planetarium, an excellent experience -with pioneering as well as newly created pieces- that has been presented multiple times since then in the same venue, given the interest of the audience.

Understanding Visual Music – UVM was created wishing this could be a positive and creative way the community can use to exchange and disseminate ideas, concepts and works, exploring deeply what we understand for visual music. From fundamental notions to aesthetics, from history to future perspectives, from technology to applied synesthesia, UVM is an invitation to creative people to gather and discuss their understanding of visual music.

This year, Brasilia is hosting the event. We have a rich and diverse program, with research and creation outcomes presented through papers and panels, distinguished keynote speakers, and concerts including about 20 world-premieres. A Computer Art Exhibition is also part of the event, trying to reach not only the specialist but to attract artists, academics, technology experts and scientists from any discipline that could contribute to the conference’s goal: a deeper and better understanding of visual music.

A space and time to meet and create new bridges of cooperation and knowledge between participants is an essential part of UVM too, and I hope new projects will emerge as a consequence from this meeting.
Thanks to everyone who has contributed to organize the event, to the institutions supporting this conference, and to all of you attending and participating of the Understanding Visual Music – UVM 2015 conference. We all expect it will be -like in previous editions- an amazing experience. Thank you all.


Dr. Antenor Ferreira Corrêa  
UVM 2015 Symposium General Chair

The planning for *UVM 2015 SYMPOSIUM* was an exciting enterprise. However, accomplishing that project was a horse of different color. While running this track, several times it seemed to me that the initial adventure was about to become an ultimate venture. Such twist happened in reason of the terrible economic crisis that hit Brazil mainly in the beginning of this year. Financial resources for universities were strongly decreased, and the Foundations that support research faced similar situation. How to make this nave tack off with no fuel? It is not easy to answer this question, but in the middle of several problems raised for this monetary situation, I learned something that struck me: solidarism is a solution!

To start it, for ideological reasons, I completely repulse the option of charging the participants. Nowadays, I have observed many examples of how to use academic research with marketing intentions, like several journals that charge high fees to publish articles, and scientific events overcharging participants. From where I am standing, “knowledge” is a common well and should be free for everybody. So, I knocked on more than a few doors explaining how important this event is, and I asked for help to make it happen. After all, it worked! *UVM 2015 SYMPOSIUM* was made possible by a collaborative network that collected together researchers, artists, university deans, partner institutions, cultural center, embassy, colleagues, volunteers, and art lovers. All these people are moved by passion of seeking out the *new* – new forms of artistic expression, new ways of acquiring knowledge, new models of discovery, new pedagogical tools, new spaces for dialog, new challenges, new inspirations, new friends, ultimately, new opportunities to boldly go making our world a better place.

Within this communitarian environment, we could accomplish our mission of bringing to Brazil this leadership event, which allows a special space for reflection and sharing of ideas. Doing
this, we will introduce in Brazil the avant-garde of art and tech, i.e., visual music and its related subjects. Moreover, I am particularly happy because we accomplished this mission with a respectful commitment to all participants.

During these three days, we will be dealing with the concept of research-creation. In this sense, we aim to integrate creative processes, experimental aesthetic elements, artistic works, and technological innovation as an integral part of the study and scientific research. The conferences, round-table, thematic panels, workshops, and paper presentation are intended to nurture this discussion and promote insights in themes like interactivity, digital art education, aesthetic, history, performance, creativity, technology, and innovation in arts. We also aim to create room for socializing and exchange of ideas among researchers, artists, scholars, students, and audience, hoping for the development of future collaborations. Finally, the Computer Art Exhibition and the projection of 27 visual music works selected by the scientific committee complement this enterprise.

I hope you enjoy it!

THE COMPUTER ART EXHIBITION

Dr. Suzete Venturelli
UVM 2015 Symposium Associated Chair

Computer Art features pieces of work whose aesthetic translates into artistic products the process of pragmatic use of abstract information systems. Computer Art has a special feature, also found in art history, which is to be an art of the model, in the mathematical sense of this term.

Since the second half of the 1980s, artists have shown the potential of Computer Art derived from matrices, known as information of synthesis or numeric information. The computer artists reached abstractions by means of a progressive departure from a referent, and by making use of a reproductive cycle of dematerialization of information, which is intrinsic to the morphology of that referent. This practice is based on an encoded, calculated, and simulated reproduction by a machine. The space of simulation and interpretation of the artistic work is amplified by a special space-time-sensory, which is also characterized by the means of communication, interactivity, and hybridization of technology resources.

Due to the close relationship between technology and visual music, we have included Computer Art Exhibition as part of UVM 2015 Symposium. This exhibition features interactive works by national and international artists who emphasize public participation in the generation of images.
and sounds in real time. Sixteen artistic works, specially sent to *UVM 2015 Symposium*, illustrate some research results developed in laboratories associated with the leading universities in Brazil.

Be welcome!
Observation:
The authors are exclusively responsible for ideas and positions presented in their respective texts, as well as responsible for their grammatical content. UVM 2015 SYMPOSIUM not necessarily subscribes those positions and ideas, as well as did not provide proofreading or any type of revisions for these texts.
VISUAL MUSIC: DISPLAY FORMATS. FULL-DOME PROJECTS. THE LANGUAGE OF A/V SPATIALISATION

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Abstract
If the medium of cinema is born of the addition of temporality to images, new trends in digital art such as architectural mapping video projection, audiovisual (A/V) performance, and new forms of immersive scenography are adding the spatial dimension to the moving image. The latest innovations in the area of digital arts are the result of an acceleration of a trend that can be historically identified through the multiple manifestations of universal expositions. Today’s digital explosion is in fact a consequence of the democratization of instruments that control light, sound, and images through increasingly sophisticated interfaces. Avant-garde artistic approaches, with their constant push toward the dematerialization of artwork, have merged with scenographic spatialization technologies. This merger of worlds has led to new A/V performance productions that reveal the emergence of a new language, namely that of audiovisual spatialization. This language leverages the creative potential of new audiovisual instruments by combining sound and light waves with the spatial component. This paper will address this new approach based on analysis of multiple case studies.

Key words:
A/V spatialisation, A/V performance, full-dome projects, digital art.

Introduction
Since the 19th century, the exceptional context of world expositions has fostered the creation of novel experiences that have promoted the technological utopias of modern times. Based on this contextual backdrop, the purpose of the present article is to define a conceptual framework by which to analyze audiovisual spatialization projects. If the medium of cinema is born of the addition of temporality to images, new trends in digital art such as architectural video projection, audiovisual (A/V) performance, and new forms of immersive scenography are adding the spatial dimension to the moving image. The latest innovations in the area of digital arts are the result of an acceleration of a trend that can be historically identified through the multiple manifestations of universal expositions. Today’s digital explosion is in fact a consequence of the democratization of instruments that control light, sound, and images through increasingly sophisticated interfaces. Avant-garde artistic approaches, with their constant push toward the dematerialization of artwork, have merged with scenographic spatialization technologies involving image and sound. This merger of worlds has led to new A/V performance productions that reveal the emergence of a new
language, namely that of audiovisual spatialization. In the tradition of colour organs, this language leverages the creative potential of audiovisual instruments by combining sound and light waves. This paper will address the language dimension of A/V spatialization, which will be analyzed based on multiple case studies.

**Universal expositions and the artistic avant-garde**

The phenomenon we will be addressing here, which clearly emerged in 1958 with the futuristic architecture of the Philips world fair pavilion, is the transformation of architectural space into a visual music instrument. In this regard, it is also important to mention the Morrison Planetarium’s *Vortex* program in San Francisco, for which Jordan Belson produced spatialized visual music compositions over the music of composer Henry Jacobs. Furthermore, after the mythical *9 Evenings: Theatre and Engineering* produced in 1966, the E.A.T. or Experiments in Art and Technology collective reached a pinnacle with the Pepsi Pavilion at the Osaka World Fair in 1970, where it created an experimental space at the frontier of historic avant-garde artists’ revolutionary approaches and major collective experiences in the world exposition tradition.

As the area of A/V spatialization has evolved, a trend has emerged to design performance methods that enable the exposition of multiple projects. In fact, far from being the final stage of a digital art project, the performance stage has become a starting point. This experimental approach is well illustrated by three examples: the Corbusier Pavilion presenting composer Edgar Varese’s *Poème électronique*, the San Francisco Planetarium presenting *Vortex*, and the Pepsi Pavilion featuring an immersive dome at the 1970 World Fair.

All three of these projects offered artists an architectural medium by which to compose their works, thereby inviting them to take advantage of the creative potential of specific in situ architecture. The Pepsi Pavilion, for example, consisted of a dome-shaped structure featuring suspended images that were reflected by mirrors and accompanied by spatialized electronic music.¹

Progressively, this type of experimental approach has broken free of the constraints of the universal exposition context to colonize the art world. To give an example, the Acousmonium system designed by the GRM (Groupe de recherche musicale) uses an orchestra of speakers for the purposes of musical creation. This setup influences the group’s compositions, enables the artists to focus on expressive dimensions, and allows the creation of a repertoire of works by multiple artists and composers.

¹ “The Pepsi Cola Pavilion was created as an adaptable multimedia instrument, which could take on different personalities according to its programming by a variety of artists” (Zvonar: e_contact, n.d.).
Although the spatial dimension is not the only discursive criterion involved (artists also compose with timbre, pitch, and sound texture), the scenic dimension does influence the composition and the performance of works. The artistry resides not only in sound composition, but also in sound spatialization. According to this view, the spatialization of screens and speakers influences the composition process.

In the area of digital arts, over the last few years, Recombinant Media Labs (RML) has been inviting artists to take advantage of the artistic potential of audiovisual spatialization media. Using a scenic composition of 10 video screens arranged in a cube formation, and a sound system of 8 wide-frequency speakers and 12 low-frequency speakers, the CineChamber project gives composers, architects, visual artists, and students access to an architecture of performance. This type of approach requires the synchronization of a specific scenography and of an audiovisual spatialization system.

**The Satosphère of the Société des arts technologiques de Montréal**

The Satosphère in Montreal stands apart from the vast majority of immersive domes by its flexible performance of specialized content. For several years, the dome has served as a veritable immersion laboratory for theatre, circus, digital gaming, celebratory events, and conference projects. The dome is designed to go beyond technological constraints and serves as a platform for numerous artists. It has been used for dance, experimental music, theatre, modern music, and celebratory projects, and will soon be used for conferences, demonstrations, and telepresence events that spatially connect the dome with other locations. Established artists from the digital arts and A/V performance scene, such as Kurt Hentschlager, Joanie Lemercier, 1024 Architecture artists, and Mathieu LeSourd, have all contributed to producing content adapted to the facilities’ formal possibilities.

Unlike with universal expositions, these facility-instruments allow artists to take advantage of the inherent language of their configuration. In other words, such A/V instruments enable users to experience a much broader variety of content than they would in the context of a one-time event. An example is the VjGraph project illustrated in Figure 1. For this project, I spatialized more than fifty films and videos whose moving images were accompanied by a soundtrack.
Transposing content to multiple performance venues

On the opposite end of the spectrum from the CineChamber approach, it is also possible to transpose the same project to several different venues (see Figure 2). This approach sheds light on the influence of the instrument on the process of generating audiovisual content. For example, I transposed the content of the White Box project to several performance venues. The first version of the project, which was performed in the Cinquième salle at Montreal’s Place des Arts, was designed for a three-screen setup. The Gaité Lyrique venue in Paris distributed the video over eight screens in a cubelike setup. The Naexus facility used a single panoramic feed reconstructed by three video projectors. Finally, Les Dominicains used video mapping via four superimposed video projections. All of these projects were configured with four to eight speakers set up throughout the performance space. During the performance, composer Alain Thibault played pieces involving two, four, or eight sound channels, depending on the context. These various experiments led me to design projects that take into account the possibility of performing within multiple venues. Each new venue is a new version of the project.

The Gaité Lyrique enabled image spatialization through five synchronized computers connected in a series to eight video projectors. The sound was quadraphonic. The audio and visual computers exchanged commands in order to play clips and effects in real time. From the outset of the project, we chose a multichannel video solution\(^2\) that would allow us to enhance the piece’s

\(^2\) A multichannel video solution consists in synchronizing several computers in order to calculate the overall image. For
resolution in comparison to the original three-screen version by adding more computers. For the purposes of Gaité Lyrique, since it was almost impossible for audience members to take in the entire video surface at once, I used the cube setup to display identical sequences in a mirror position. I consequently adapted the video configuration of the White Box project to the specific performance space at Gaité Lyrique.

1- Place des arts.
2- Gaité Lyrique.
3- Naexus.
4- Dominicains.

Figure 2: Dispositifs de diffusion du projet White Box (2011-2014)

By synchronizing several computers with multichannel video, I was able to add as many screens as necessary for multiple performance venues. The multiple transpositions of the White Box project, using three to eight screens and various configurations, shed light on the influence of the venue on the A/V composition process. Some versions of the project used venues with front-facing configurations while others occupied the entire performance space. In view of the many configurations made possible by new visual spatialization technologies, any surface can become a

example, using one computer per screen enables higher resolution. Conversely, it is possible to use a single-channel solution by means of a single, very high resolution video feed that is split into several screens.
projection surface. The result is that space becomes an integral part of the audiovisual composition process.

Like the White Box project, *Enigm(a)* adopts a multi-venue approach, but this time with special emphasis on the issue of content. More specifically, the experiential space involves multiple visualizations in the same media space. The sound visualizations shown in Figure 3 are as follows:

1. Data visualization (data mining)
2. Audio text transcoding
3. Graphic symbols
4. Metaphorical visualization
5. Sound envelope
6. Spectrum
7. Reactive 3D shapes
8. Narrative illustration
9. Face capture and point cloud

The second part of Figure 3 offers an example of spatialization. The project will be transposed to multiple screen configurations, with a view to approaching each performance in accordance with the specific performance space in situ.

**The spatialization of images and sounds**

Images are never perceived outside one’s limited peripheral field of view. In contrast, sound has no container or fixed frame (Chion, 2005). Sound waves are immersive by nature; they come from all sides at once and travel through the body. Sound waves are not bound by the same
perceptual limitations as images. However, it is possible to distinguish between the space within sound and the sound within space. This is also true of images, as we will see.

When sound is spatialized by the position of speakers, the audience can more easily locate the source of high-pitched sounds owing to their shorter wavelengths. The source of low frequencies is much more difficult to perceive, given that the wavelengths tend to occupy the entire space. The sound space also depends on the audience’s perception of the distance “within” the sound itself. For example, a limited-spectrum sound can be perceived as more distant, regardless of its actual location in the performance space. Similarly, there is a distinction to be made between the space within the image and the image within space. The space within the image is what creates the illusion of depth on a screen, whereas the image within space has to do with its location in the performance venue.

An A/V composition is always at the crossroads between two spaces. When buildings shake, collapse, are unbuilt or rebuilt, or are otherwise transformed via simulation in the creations of the label Anti-Vj, the artwork is at the crossroads between the reality of the architectural surface and the virtuality of the visual deconstruction. For example, discussing her installation project Eyjafjallajökull inspired by the famous volcano by the same name, artist Joannie Lemercier emphasized how her project, by modifying the audience’s perception of images, manipulated its perception of reality (Anti Vj documentary, 2015). AntiVj is very much active in the area of A/V performance; collaborative efforts between electronic music composer Murcof and visual artist Simon Geilfus use a tulle screen that plunges the performers in the middle of a 3D simulation. The depth of the virtual space merges with the scenic space (idem).

The 1024 Architecture collective used the same strategy in designing its scenic creation Boom Box (1023 architecture, 2009). The installation is presented as a giant sound box, with the performer located in the middle. A scaffolding of screens allows for video projections across the project surface, producing volumetric shapes. The play of projections creates false perspectives and shifting anamorphoses that situate the musicians and performers within virtual spaces.

Finally, audio and visual spaces can be merged when common visual and audio positions are created on the azimuth axis (x), the pan axis (y), and the depth axis (z). In addition, frequencies can be altered to produce the illusion that perfectly synchronized sounds and images occupy the same position within the virtual space. Composer Zack Settel is currently researching this subject through various projects such as Ball Jam, SoundScape, and Physiosonics (Zack Settel, n.d.).
The language of spatialization

With the advent of panoramic and spherical image projection, the frame of action is no longer limited by the screen format and can virtually portray a global space, thereby changing the function of the shot and the frame as understood in the language of cinema. A 360° work, for example, can be performed within a single shot-sequence by including all possible views of the scene. By abolishing the frame of the image and offering audience members the possibility of choosing their own point of view, immersive approaches considerably change the process of designing and receiving works of art.

As a result, the status of the shot in the field of A/V performance is distinct from its status in cinema. An example of this can be seen in the composition of the *After Dark* project, which had virtually no audio-visual breaks but consisted of seamless, superimposed, progressively evolving panoramic animations.

Performances by A/V spatialization firms Granular Synthesis, Anti Vj, LabAU, and Cécile Babiole likewise involve a near absence of breaks between shots. This characteristic is related to the nature of the musical composition, but also results from a specific intent, which is to create virtual worlds as opposed to fictional worlds.

Other works will use multiple breaks in keeping with the rhythm of the musical composition. For instance, the composition of the *White Box* project was based on a dialogue of alternation between lengthy minutes-long sequences and sharp, violent breaks (see *White Box* on vimeo). The intent behind the breaks was to signal a passage between sections, to remove the audience from the virtual space, or to make a sudden change to “reset” the audiovisual composition.

The difference between a front-facing experience and an immersion has a direct impact on the audiovisual composition process. The number and variety of available performance venues also clearly require the composer to take into account the spatialization of elements in both virtual and real worlds.

Audience attention

When it comes to distributing and guiding public attention to specific elements within immersive 360° settings, there are three different approaches.\(^3\) Audience attention can be uniformly distributed by creating unified environments, or conversely focused on a specific point (for

\(^3\) In the words of Olivier Grau: “The viewpoint is no longer static or dynamically linear, as the film, but theoretically includes an infinite number of possible perspectives” (Grau, 2003, p.16).
instance with compositions that merge elements at the centre of the image), or destabilized by creating multiple points of interest across a given surface.

Unified environments can be clearly illustrated by certain extreme examples. Some works by the duo Granular Synthesis are characterized by an absence of visual points on which to focus one’s gaze, for instance. To prevent the audience from focusing on a specific point, this duo creates projects that feature sound and visual elements that could be compared to a magnetic field—in other words, they create abstract environments that escape any narrative logic. In organizing the visuals of their immersive environments, the duo avoids directing the audience’s gaze to specific points by distributing the visual material equally across the entire projection surface. This approach is exemplified by *Feed*, a project by Kurt Henschlager (see References), formerly of the Granular Synthesis duo (see References). During the performance, the room is plunged into a thick fog, so that members of the audience are completely isolated. The fog is so complete that it becomes impossible to even make out one’s own hands or the hands of fellow audience members. Bombarded with visual pulses, and under the effect of the fog, the audience experiences altered perception and veritable hallucinations. This is the ultimate example of an immersive experience without visual reference points.

On the opposite end of the spectrum from this “all over” magnetic field-like approach à la Jackson Pollock is the approach of composing in such a way that everything converges towards one central point. This is the case, for example, in *A-Light*, which I produced together with composer Alain Thibault in 1998. The composition’s light pulses all converge toward the middle of the image. Some portions of the piece also blur audience perception using various distortion effects. This strategy is incorporated within an immersive environment. The lines of the image converge at the center of the dome, and the audience members’ experience of the image varies depending on each individual’s point of observation.

Finally, the third approach is to offer multiple perceptual focal points at the same time. A clear example would be the performance of *After Dark*, a panoramic video composition in which the audience is unable to take in the entire screen all at once; in this context, I produced topologically opposed events to offer audience members multiple simultaneous perceptual focal points.

The issue of manipulating audience attention is not easy to define, given that it depends on the unique perception of each individual. However, it is essential to establish the above distinctions in order to show how the performance space can influence the composition process.
Conclusion

As we have demonstrated, the addition of the spatial dimension to images, in conjunction with the democratization of image and sound spatialization tools, has given rise to a specific language created by the merging of several disciplines. Over and beyond the technology involved, the real issue lies in the design and creation of the audience’s experience. Accordingly, it is important to develop new models of audiovisual production analysis that will shed more light on this language. To borrow the title of a seminar held in Paris in 2014, research needs to be geared toward the “design de l’attention” in order to understand audience relationships to automated technologies. This issue is precisely the subject of the Nuée | Swarm project (Figure 4). Launched in the context of the second Symposium iX at the Société des Arts technologiques (May 20, 2015), this project consists in performing a 10-minute visual music piece inspired by the complex phenomenon of swarms. The concentration and diffusion of sound and particle masses is intended to focus or disperse audience concentration using various points distributed in space. Beyond its poetic dimension, this work is ultimately aimed at literally conceiving the language of spatialization as a form of emotion design.
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Internet website consulted:


Abstract
In the field of visual music, numerous pioneering artworks have been created in 2D or virtual 3D forms. In comparison, there has been limited attention on utilizing three-dimensional physical space as part of the visual music performance. Extending previous visual music practices, the current study considers the physical space as an object, instead of a container. The physical space can be associated to music in different ways, and capable of conveying symbolic meanings. The author used a series of experimental projects to explore the feasibility of combining physical space with visual music. This article describes two visual scores, which were developed in an attempt of exploring the methods in which the physical space can be associated with music and whether the combination between physical space and visual music is beneficial for an enhanced visual-auditory experience.

Keywords
Visual music, physical space, warp, distortion

Introduction
Among a variety of art forms, a genre that focusing particularly on the unity of sound and visual is visual music. Alexander Wallace Rimington (2004) claimed that just like sound, color is capable of expressing artistic emotions. Subsequent visual music studies not only lend support to Rimington’s argument, but went further to show that not only color, but many other visual attributes (e.g., shape, brightness, motion, path and etc.) are also capable of doing so. For example, Gyorgy Kepes (1944) linked musical melody with visual path by claiming that the function of the kinetic linear path in plastic organization may be compared with the function of melody in musical composition.

Extending this line of inquiry, it is reasonable to ask that can physical space be treated in similar ways like the color, shape, brightness and other visual attributes, which are associated to music and has emotional appeal?

The current research proposes that the physical space can be regarded as an object for visual

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5 Alexander Wallace Rimington wrote in his article A New Art: Colour-Music: “That colour, like sound, is capable of expressing artistic emotion there can, I think, be no question…” (2004, p. 47)
music installations, and therefore creates a new genre of visual-auditory experience, which can be understood as “spatial visual music”.

The next two sections give reviews on the studies and works that related to physical space in the field of visual music, and in the art field in general.

**Visual Music Studies and Works Related to Physical Space**

In 1950, Oskar Fischinger patented his invention “Lumigraph”, an instrument for playing lights (Betancourt, 2004). It allows the players to create dynamic light effects by pushing a rubberized screen, on which sets of color lights are projected (Moritz, 2004).

Fischinger’s instrument provided an example of associating physical space with visual music performance. In particular, the lighting elements create a three-dimensional light field in front of the screen. The visual effect is determined by how much an object (screen, hands or other props) is pushed into this light field. If we draw a three-dimensional coordinates for this light field (see Figure 1), then the degree of depth (z) can be mapped with musical elements such as volume and accents, which can enhance the richness of artistic expression.

![Figure 1: Three-dimensional coordinates of the light field.](image)

In 2009, Nathalie Miebach, a Boston-based artist, created a series of 3D musical sculptures (see Figure 2), in which weather and climate change data are translated into vibrant, whimsical and other musical elements. These sculptures can be regarded as musical scores for a string quartet to play (Smith, 2014).
A recent work involving the utilization of physical space is *Mizalu*, created by Aaron Sherwood and Mike Allison. It is an interactive installation which allow performer / audience to “play” with a stretchy sheet of spandex to create synchronized visual and sound effect. According to Sherwood and Allison (2012), both the stretchy screen and the action of push have symbolic meanings: the concept of this installation is about “death and experience of reality, so this membrane represents a plane that you can experience but never get through” (para.2).

**Space in Arts**

Space has always been a major concern throughout the history of art (Stella, 1986; Ione & Tyler, 2001). While we try to classify artworks as Fauvism, Cubism, Futurism, Surrealism, and so forth, these categorizations fail to reflect how diverse the practices are in dealing with space (Ione, 2005).

A common understanding of the function of space in art believes that the space is a form of mental representation rather than objective reflection of reality. In *Warped Space: Art, Architecture, and Anxiety in Modern Culture*, Anthony Vidler (2001) wrote:

“Space, in these various iterations, has been increasingly defined as a product of subjective projection and introjection, as opposed to stable container of objects and bodies. From the beginning of the century, the apparently fixed laws of perspective have been transformed, transgressed, and ignored in the search to represent the space of modern identity. Thus the body in pieces, physiognomy distorted by inner pain, architectural space as claustrophobic, urban space as agoraphobic, all warpings of the normal to express the pathological became the leitmotifs of avant-garde art.”

(p.1)

In 1998, David Worrall wrote an article titled *Space in Sound: Sound of Space*, in which he introduced his experiments in using physical space for musical composition. His research focused

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7 In Worrall’s article, he called the space as “3-space”, which means concrete space, or real space. OED defined the concrete space as: “1. Continuous extension viewed with or without reference to the existence of objects within it; 2.
particularly on the connections between physical space and the characteristics of sound:

“... A prime concern during the development of this performance environment was how to integrate 3-space into different composing methodologies. I began, perhaps naturally enough, to think of 3-space as a locational aspect of sound which could be added as another dimension to an abstract multidimensional musical space of pitch, duration, dynamic and timbre.” (Worrall, 1998, p. 94)

Elena de Bértola is another artist who associated space with auditory art. She pointed out that “how music, an art considered to be essentially temporal, also produces in listeners a consciousness of space” (de Bertola, 1972, p. 28). She stated:

“When one speaks about ‘sound’ space, it is as an appropriate analogy of visual space. In effect, whenever one speaks of ‘space’, one generally means visual space and, in a parallel sense, whenever one speaks of spatial perception, one thinks of visual perception.”

“Spatial music, produced by several sound sources (loud-speakers) placed in different regions of space, multiplies or diversifies the spatial effects of sounds.” (de Bertola, 1972, p. 28)

The next sections will describe the design of two visual scores, and discuss two methods in which the physical space can be used in visual music, as well as the symbolic meanings of these combinations.


One motive of involving physical space in visual music is to warp the rectilinear timeline in 2D surface into another “pathway” in 3D physical space to parallel different sections.

Figure 3 is a visual score of a Chinese music piece named “Tagu” (the first 2’30”), which is composed by Lin Hai. “Tagu” is also associated with a special type of ancient dance – the dancers wear special leather shoes, stamp on a set of drums to create beautiful movements and sound at the same time. The dancers’ stamp gives the basic tempos, and musicians play other instruments to give the melody, which also correspondent with the dancers’ body movements.

Figure 3: Hand-painted visual score “Tagu”.

Interval between points or objects viewed as having one, two or three dimensions.”
The theme tempos start from the very beginning (0’00”) with no other sound accompanied; From 0’06”, a continuous sound entered to furnish an atmosphere or background; At 0’30”, the major melody is played by a traditional Chinese musical instrument called Pipa, also known as “Chinese lute”, which is one of the most popular Chinese instruments and has been played for almost two thousand years (Figure 4 is from a famous painting called “Night Banquets of Han Xizai” dating back to Tang Dynasty which shows a musician playing Pipa).

![Image of Night Banquets of Han Xizai](image)

Figure 4: Detail of “Night Banquets of Han Xizai” (by Gu Hongzhong).

To visualize the theme tempos from 0’00” to 1’26” (see Figure 5), I used a set of small square in browns to represent a group of stamps, and repeat the set as the sound of the stamps are repeating with the fixed pattern every two seconds. I chose to use browns and square shape because I felt that the sounds of the stamps are strong, snappy and firm. The dark browns and squares give me the strong and firm impression, and the light-brown squares are snappy. After 1’26”, the theme tempo changed slightly, but still keep repeating every two seconds. Instead of the rapid and intensive 9 stamps before 1’26”, the beats changed to two major downbeats and two small taps. The timbre also changed to be less firm but more energetic as marked by the red squares (see Figure 6).
To visualize the second “layer” of the music, which is a continuous sound that entered from 0’06”, I chose gauzy and half-transparent bright yellow curves to indicate the melody, and even more light and subtle yellows (which have no fixed shapes like clouds or fog) to indicate the echo and “atmosphere” that the sound created. After 1’26”, these bright yellow curves changed to more passionate ones. So I add scarlet and yellow red and change the degree of curvature from graceful and subdued to ardent, to express the feelings of passion.

There is a Chinese poem wrote by Bai Ju-Yi (816 AD) from Tang Dynasty describing an experience of hearing a Pipa performance, it was translated by Ying Sun (2008) as follow:

“… The bass strings rumbled like thunderstorms pelting, the treble strings rustled like lovers whispering. Rumbling and rustling interleaved at a fast rate, like large and small pearls falling on a jade plate …” (line. 23-26)

8 The title of the poem is *The Pipa Tune*. It was written in 816 AD by Bai Ju-Yi.
The timbre of Pipa gives powerful, vigorous and elastic feelings. Both of its sound and shape (as well as the body posture of the performer) give a beautiful feminine impression. Pipa is also one of the special musical instruments that considered to be used by Chinese goddesses in the heaven. There are large numbers of frescoes in the Dunhuang Caves depicting the goddesses playing heavenly music using Pipa (Figure 7).

![Figure 7: Photos of the Dunhuang frescoe.](image)

The inspirations of the curly shapes (the green patterns) in this visual score that I used to visualize the music played by Pipa are: 1. The shape of Pipa itself; 2. The sound of Pipa (the curly shapes are the elastic melody, and the individual circles symbolized that the sound is like pearls dropping into a jade plate); 3. The frescoes of the goddesses who play it; 4. The traditional Chinese decorative patterns of a divine animal called Fenghuang\(^9\) (Figure 8).

![Figure 8: A pattern of Fenghuang.](image)

If we wrap the 2D plane (2D painted score) into a cylinder or spiral, it becomes a 3D score that exist in physical space. Since the score itself is about the relationship between time and musical notes, this warp is capable of building connections among musical notes, time and “space”. Take

\(^9\) Fenghuang is a divine bird from ancient Chinese legend, which is commonly referred to as the phoenix. When Fenghuangs fly in the sky, they will bring divine music and spread the happiness to the world.
spiral as an example (see Figure 9): section A is the theme and section B is its mutated version. When the two sections are warped and thus overlapped with each other, the implicit relationship between the two sections becomes explicit. Based on Chinese ideology of circular thinking which believes that the history is fundamentally an endless cyclical process (Yao, 2001), the warped timeline of the visual score symbolizes the transmigration of history: what happened in the past will happen again some point in the future, though with slightly changes in its “appearance”. These “present” and “past” have impacts on each other as well. As Ratey (2001) mentioned that the past experience and memories come and go every moment with impacts on our present life; and the current situation such as the mood and surroundings also changes our attitude and in turn, influences the memories (p.186). Thus, the warped timeline is capable of paralleling different sections that take place in different time period, and reveal the connections between “now” and “past”.

Figure 9: Diagram of the 3D cylinder (spiral path)

3D Visual Score – “The Butterfly Lovers”

In 1944, Gyorgy Kepes associated musical melody with visual path, which he stated in *Language of Vision* as follow:

“The function of the kinetic linear path in plastic organization may be compared with the function of melody in musical composition…”

“Music, theoretically considered, consists altogether of lines of tone. It more nearly resembles a picture or an architectural drawing, than any other art creation; the difference being that in a drawing the lines are visible and constant, while in music they are audible and in motion. The separate tones are the points through which the lines are drawn; and the impression which is intended, and which is apprehended by the intelligent listener, is not that of single tones, but of continuous lines of tones, describing movements, curves and angles, rising, falling, poising—directly analogous to the linear impressions conveyed by a picture or drawing.”

(1944, p. 59)
Inspired by the pioneering studies, the author is interested in the spatial features of both visuals and sounds, and the possible combination of 3D physical space and visual music performance. The author proposes that besides melody, there are other musical (auditory) attributes that can be associated to “path” as well, such as the volume and the dynamics. Since the auditory attributes like volume and dynamics are capable of providing spatial information (Bulkin & Groh, 2006), the author claims that these auditory attributes can be linked not only to the 2D path, but also the three-dimensional path in physical space. The 3D visual score “The Butterfly Lovers” (Figure 10) is an example of associating dynamics with three-dimensional path.

![Figure 10: 3D visual score “The Butterfly Lovers”](image)

The author created this 3D visual score for violin concerto “The Butterfly Lovers”\(^{10}\). The violin concerto “The Butterfly Lovers” is based on a Chinese tragic love story of a pair of lovers of the same name.

![Figure 11: Diagram of the warped timeline](image)
purpose of designing this score into a three-dimensional sculpture is to better present its dynamic musical feature – the “melody” of forte and piano. In particular, in real space we are intent to perceive the strong sound as close to us, and soft sound far away. In music, as the volume keeps fluctuating, we can feel that the sound “moving forwards and backwards”. Therefore, the author presents the fluctuating dynamics of music visually using a three-dimensional spiral path, with its distance to audience changing from time to time (see Figure 11). The entire path takes on a circular shape to symbolize the hero and heroine’s everlasting love: even death cannot stop them from “being together”. They turn into a pair of butterflies and never to be separated again.

In addition, in performance, like musicians has their own interpretation towards the music (which know as a bis inditement process that deducts the notes in the text form into emotional music), dynamics and rhythm reflect the musicians’ emotion as well. Therefore, this 3D visual score is capable of indicating the emotional aspects of a musical performance.

Conclusion

As Frank Stella (1986) stated that “the aim of art is to create space…” (p. 5), physical space as a powerful tool for artistic expression has been utilized by various art forms. Clearly, in the field of visual music, we are just beginning to explore the utilization of physical space. Much work needs to be done in fully developing the function of physical space, exploring the possible combination of physical space and visual music creation, as well as experimenting the possible cooperation between physical and virtual space for enhanced audio-visual experience.

References


Abstract
Norman McLaren is one of the most important references of animation history. His works show a rich diversity of image-sound relations. However, we cannot find in the literature a systematization of the procedures he used on his audiovisual structuration. The project “Sound-Sight: searching for others audiovisualities”, developed by the research group interSignos – EBA – UFMG with resources from FAPEMIG and Cnpq, studies audiovisual relations which are alternatives for film grammar. Among other research in visual music, we organized in categories references about Norman McLaren's creation process and development that allow an overview of his approaches: animation sound through drawn on the film or through the card method of animation sound (by itself or with addition of other sounds and final mix); recorded musics or songs (chosen after or before animation); the choreographic organization of the images. This article also introduces important concepts about McLaren's aesthetics choices to connect image and sound: sync; analogy; the search for the unrepresentable; the temporality; Minimalism. Our work allows to better understand Norman McLaren's transensoriality to build “audiovisual objects” that, according to Palmeirim (2012), join image and sound to the point that it is not possible to separate them..

Keywords
Audiovisual, Norman McLaren, sound, music

Introduction
Norman McLaren is known for his innovations in producing animation and his musical score. The way your animations are articulated with the audio reveals a desire for expression and exploration of the relations image - sound, which produces in the viewer a unique aesthetic experience. Our project "Sound - sight: in search of other audiovisualidades " that research relations strategies between image and music Visual Music, investigated the forms of articulation of McLaren, trying to understand the patterns, designs and aesthetic choices of his work .

Brief History
Norman McLaren was born on April 11th, 1914. In his childhood and adolescence he studied some piano and violin. His interest for animation started when he was studying at Glasgow School of
Art, where he specialized in Interior Design in 1936. Even though his great interest about reading musical subjects and listening to classic, folk and jazz music, he believed that his musical education was not enough to compose more complex music to his own films.

In 1937, he joined to British General Post Office and it was in this job that he started to develop his experiments with synthetic sound (what would become the technique of “Animated sound”). These experiments continued to be explored when he moved out to New York, in 1939, where he made films to the Guggenheim Museum of Non-Objective Art. At this time, McLaren had already developed his technique to the point of having a musical chromatic scale of five octaves. In 1941, Norman McLaren started to work at National Film Board of Canada, where he stayed until the end of his career and where he had the freedom to explore many techniques to animate and to produce soundtracks. At National Film Board of Canada, he worked in partnership with animator Evelyn Lambart, with whom he made some films as "Begone Dull Care", "Mosaic" e "Rythmetic".

**Animated Sound**

Norman McLaren always wanted to compose music to his films and he achieved this aim in the method called “animated sound”, in which the animator – and in this case also composer – drew the sound on the emulsion on the film and he animated it frame by frame, as well as the image. For McLaren, the animated sound was nothing more than an extension of the process of animation itself.

The creation of animated sound derives from the observation of waves patterns through an oscilloscope and it can occur in two ways. In the first one, the drawing is made directly on the film by using paint or by scratching the emulsion of the film in its sound area. This drawing seeks to reproduce the waves patterns observed in an oscilloscope translating them graphically in bars that, once drawn time after time, making a constant pattern, they produce a musical note. It is possible to get controlled variations of pitch, intensity, rhythm and even tones (see picture 1 and 2).
In a second way, the sound is made from photographs of sound cards (they already have spaced bars patterns for each musical note) in the sound area of the film. The sounds obtained through the method of animated sound are characterized for sounding synthetic and dry (without reverb). For McLaren, in this method, the involvement of the animator/composer with the music of the film tends to be more rhythmic than melodic. He himself believed in the idea of repetition of musical patterns (as rhythmic and ostinatos patterns) rather than the development of melodic lines.

The first attempt to compose exclusively with this method was made by McLaren for the film *Neighbours*, from 1952. In this film, the artist composed a musical structure and he made it happens in different ways throughout the film. This soundtrack was made after the animation. However, McLaren had already an idea of it and in the process of animation he concerned about the rhythm of the movements to facilitate the post-production of the music. In addition to the music in *Neighbours*, Norman also made the noises of the film with this technique, highlighting the movements made by the neighbours.

Also in *Rythmetic*, from 1956, the music was made after the animation was done. However, the visual actions had already been filmed in rhythmic structures, which provides a strong pulse for the musical composition. The music was made by animated sound, obeying the rules that allow variation in pitch and intensity. Afterwards, in the re-recording process, reverb effects were added in small amounts to the soundtrack.

In *Synchromy*, from 1971, McLaren made one of his most recognized works with animated
sound. In this movie, one can hear what one can see and one can see what one can hear, because McLaren used his sound cards both for the musical and for the visual creation of the film. The music was made in the first place, starting with a simple structure that turns into a more complex structure (musical and visually). In the beginning, there is only a rectangle that represents the sound on the film surface. The rectangular shapes appear and disappear synchronized with the sound and these movements make possible to recognize a connection between what one can see and hear. From this connection, one can perceive that uneven height of the rectangles causes uneven pitches, so that the higher the height (and larger the width), lower is the sound and also the smaller the height, higher is the sound. To demonstrate this relation, McLaren varies the width of the rectangles (along with the height) showing that the thinner the width is, lower is the intensity of the sound and larger the width, louder is the intensity of the sound. Only with these two parameters, didactically revealed, the animator starts to explore the technique, doubling, tripling and so on the rectangles, in other words, he adds sound layers to the soundtrack, creating polyrhythm and dynamic in the music. It is important to remember that the sound variations are accompanied by the image that, therefore, becomes as complex as the music. As the sound complexity increases, new elements arises in unstable compositions and the colouring, almost monochrome in the beginning, becomes more saturated and full of contrasts.

**Library music – Before animation**

McLaren also made animations from music and songs that were not made for the audiovisual. The pictures on the screen dance according to the music in these experiments of colours and movements. This choreography of images (discussed bellow) based on a piece of music already composed was made in the film *Polychrome Phantasy*, from 1935, in which the animation follows the waltz of Johann Strauss. Musical arrangements also were made from already composed pieces (extracted from the sound library of the *National Film Board* itself), as did the composer Louis Applebaum to the film *A Little Phantasy*, from 1946, after the animation of the images.

When McLaren worked with songs, the animator could use the lyrics to inspire himself, as he did in *La Poulette Grise*, from 1947, film in which the animator based his work on the lyrics of the folk song, illustrating the meaning of the words.

**Original music – Before animation**

In most of Norman McLaren's audiovisual works, the music was composed before the animation. Some examples are *Begone Dull Care* (1949) and *Blinkity Blank* (1955).

In the first one, Norman worked with Oscar Perteson's jazz trio. The music was the result of
repetitive sessions of improvisations from the trio along with the animator. He already had in mind some ideas to guide the pianist. However, this was a two-hands work because Oscar Peterson also gave many musical ideas to McLaren. After the music was done, there was a preparation to produce the images of the film: each musical note and phase was transferred to a dope-sheet (a guidance document in which the animator plans each frame of the film while he still can relate them to sounds in seconds and/or musical figures). This principle of “translating” the music to the time of the animation was always used when McLaren used music as an inspiration to create images.

In *Blinkity Blank*, the musical track was composed by Maurice Blackburn from procedures of contemporary music. The musicians were guided in an “almost free” improvisation, in which they could choose the musical notes they would play. The “score” they received only indicated the pitch the musical note should have, as low, medium or high. However, other factors as the compass, rhythm pattern, dynamic and time were used in the traditional way. Furthermore, the recording was made without rehearsal, catching the musicians by surprise to ensure the spontaneity of the improvisation. Afterwards, in the final mix, percussive sounds from the technique of animated sound were added to the track of traditional instruments. This method of mixing the synthetic sonority and the “natural” sonority is also present in other films, as *A Phantasy*, from 1948. In *Blinkity Blank*, McLaren investigate the possibilities of intermittent animation and spasmodic imagery\(^\text{11}\), in which the drawn image persists on the retina and the brain keeps it until one new image appears on the screen. In most frames there were no drawings, the flow of the images happens because of this principle. Maurice Blackburn knew Norman McLaren would not draw in every frame and he took this into consideration to compose the musical track of the film. Blackburn included considerable amounts of silence among the musical notes, phases and chords.

**Original music – after animation**

In other cases, the music was composed and recorded after the animation was finished. In this process, the music usually was structured from motifs and themes that can be associated to the characters of the film and/or to specific situations. In the two last sections of *Canon*, from 1964, the piano music was composed respecting the visual canon, as if it was translating it to the musical structure. However, during the animation process, the actors were directed to act in an accurate pulse, facilitating the future work of the composer. The first part of *Canon* is made by the method of animated sound, demonstrating how the animator could mix techniques in only one film.

\(^{11}\) “To bypass this problem *Blinkity Blank* intentionally set out to investigate the possibilities of intermittent animation and spasmodic imagery.” (McLaren, 1955, Technical notes by Norman McLaren, pag 7)
In *Chairy Tale*, from 1957, Norman McLaren invited Ravi Shankar and his percussionist to watch the soundless film and the sitarist demonstrated a big interest to compose its soundtrack. McLaren did then a schematic map of the movie to the composer, describing each action and part of the movie with the aid of colors, diagrammatic marks, numbers and names. After the familiarity with the film, that lasted about three weeks, Ravi Shankar and his percussionist recorded the music along with repetitive projections of the film. Also were recorded some special effects by the sitar and some other percussive sounds that were added in the sound final mix.

In *Lines-_horizontal*, from 1961-62, the music was composed by Peter Seeger, a famous American folk musician. He divided the film in four sections and he worked on each one with different blocs of instruments, being the last one a regress to the initial instrumentation. The music was improvised while the film was projected. However, Seeger recorded each instrument (two wooden flutes, a five string banjo, a mandolin, a six and twelve string guitar, drums and an autoharp) individually, improvising with the recording of the instrument(s) that was(were) already recorded and, sometimes, omitting some track already recorded. Sound effects also were added, as the sound of a thunder.

In *Lines-vertical*, from 1960, the music composed by Maurice Blackburn was half composed and half improvised from a pentatonic scale. He worked freely on musical motifs for each section/sequence of the film.

*Pas De Deux*, from 1967, was afterwards set to sound by Maurice Blackburn. The music follows the development of the images, with accents of panpipe on the most intense moments of the narrative. The composer's choice for such tone was due to the undeniable “human breath” that wind instrument gave to the film, whose characters are a pair of dancers.

In *Narcissus*, from 1983, besides the use of traditional instruments, there are also some McLaren's interventions through animated sound. However, the animator respected the score composed by Maurice Blackburn. In the composer's point of view, the music should give a subconscious interpretation to the story and it should not attract the attention of the audience for itself, because the content of the film was, foremost, represented by the images. Comparing to other McLaren's work, *Narcissus* does not present a balance between image and sound, the music here seems to have less importance. It only gives support to the image without constituting different audiovisual relations.

**Animated sound with voice and reverber**

Besides of the musical material from recordings and the sound synthesis propitiated by the
animated sound, another layer of sound articulation was included in the mixing. Different degrees of sound manipulation can be perceived as variations of dynamic and addiction of reverberation.

In Mosaic, from 1965, the rhythmic part of the film was made by the technique of animated sound, scratching the emulsion of the film. In the final mix were added human whistles and once there were long amounts of silence among the percussive sound, echo effects and reverb also were added to the soundtrack.

**Important concepts on McLaren's works**

Some concepts are important to understand the strategies of audiovisual articulation on McLaren's works: the dance as a structural model, the film as an audiovisual object.

**Dance as a structure:**

One of the most important relations on McLaren works comes from the dance itself. He realizes a connection among music, dance and the moving image: they all have time as a common parameter. In all McLaren's works, we can perceive a structure based on the choreography of the shapes – being them abstract or not – according to the music. This dance in the films obeys different rules of visual variation unfolding themselves in relation to the music: sometimes they vary the positioning and the movement in the screen framework, sometimes they change the geometrical shapes, colors and textures.

Within this point of view, for example, McLaren states that his biggest creative aspect for Synchromy was the “choreographing of the striations in the columns and deciding on the sequence and combination of the colours”.

More explicit examples of dances can be found clearly in Hen Hop, from 1942 – about the movements of a dancing hen (abstractedly represented) - and in Pas De Deux, Narcissus and Canon. In these last examples, the idea of a dance is clear due to the presence of actors-dancers that turn easy our association of the movement and gestures with the dance.

**Minimalism:**

Some Norman McLaren's works as Lines Horizontal and Lines Vertical, Mosaic and Synchromy have features in common with the Minimalism. This term makes reference to a series of artistic and cultural movements that emerged at United States around 1960's. The minimalism is characterized by using fundamental elements, as basic colours and simple geometric shapes in painting and arts and by using few musical notes and repetitive sounds (melodic lines, for example) in music. Some of the names that stand out are the composer Philip Glass and the plastic artist Sol Le

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12 “Apart from planning and executing the music, the only creative aspect of the film was the “choreographing” of the striations in the columns and deciding on the sequence and combination of the colours.” (McLaren, 2006, p. 58)
Witt.

The search for the use of few, but expressive fundamental elements can, at the same time, to be compared to McLaren's wish to explore animation in its purest form, as it happens in *Lines Horizontal* and *Lines Vertical* (both made in the beginning of the year 1960), in which the animator restricts himself to the more simple formal element in his opinion: the line. These films present a similar aesthetics to the works of the north-american painter Barnett Newman, known as one of the precursors of Minimalism. The use of more basic colours in McLaren's works also has connections with this movement. Some of the principles of Minimalism, as transparency, the thematic repetition and the slow development are present in the visuality and in the musicality of the aforementioned films. The transparency is present in the beginning of each film (*Lines Horizontal* and *Lines Vertical*), when, in a strategy of a presentation or opening, it is revealed to the viewer the manner the audiovisual will be constructed. The development is slow for the viewer to understand the transparency of principles and techniques used by the animator and the repetitions of thematic material make the viewer's memory alive. Having in mind that in these films the musical track is synchronized with its own visuality, the same minimalist principles can be applied to the music, as using few notes to follow the movement of a line that, during the film, develop themselves into chords and arpeggios to stress the meeting of two or more lines and the general movement of the group, as it is made in *Lines Vertical*.

**Sound and image articulation**

The clearest parameter used by McLaren to articulate image and sound in his works is the sync. In almost his works, the visual and the musical movements are synchronized, when the music is already composed before the animation and when the animation is already done before the music. In the animator's technical notes about *Begone Dull Care*, one can perceive his concern about image and sound:

(...) we tended to treat the visuals in metrical lengths of textured patterns corresponding to the paragraphs and sentences of the music. However, sudden musical accents or short phrases were later emphasized by additional painting or engraving, in which case the actual frames of the film were taken into account. In certain solo percussion sections we engraved on black film, individual frames with clearly defined images being synchronized with musical beats. (McLaren, 2006, p.6)

Often, the expression of the image and music has a similarity based on cultural concepts we have rooted inside ourselves. An example of this thought is in this stretch of a testimony of the animator about the film *Mosaic*: “*The visuals of Mosaic started in a very slow and simple way and gradually built to a climax: so I felt I had to hold back my sound too. There were tiny little things*
moving, so I felt I needed tiny little sound” (McLaren *apud* McWillians, 1991, p. 31).

In most of his visually abstract works, Norman McLaren seeks for the representation of what is “unactable”, as the music is. The sound can be graphically represented by the shape of its sound waves. However, what Norman sought was a representation with features more transensorial and intuitive. He sought to express what he felt, “saw and imagined” when he was listening to a music, in terms of colours, shapes and movement:

In my teens, before the art school, I used to hear music (...) coming from the radio stations of Europe. As I shut my eyes, I saw the play and dance of forms (...) It was only when I joined the Film Society in Glasgow that saw the first abstract film Brahms’ Fifth Hungarian Rhapsody [Hungarian Dance No. 5] made by Oskar Fischinger that I said: That’s it! Film is the medium to ex-press my feelings about music. (McLaren *apud* McWillians, 1991, p. 31)

Such testimony of the artist reveals one of the bases of his imagination and his aesthetics approach in works as: *Blinkty Blank, Begone Dull Care and Dots and Loops* (1940). The Cinema of Animation demonstrates itself as an ideal medium for the abstract exercise of audiovisual translation: it allows the development of the images in time. The notion of movement (common to Music and to Cinema) can be established and, furthermore, we can keep the sync between sound and image mutually translated.

There was a parallelism between the visual and the musical movement, but the interpreter thought also directed the choices of tones, pitches, intensities, colours and shapes. In *Synchrony*, for example, the animator-composer makes a connection between the intensity of sound and the intensity of colours in a directly proportional proportion:

In general the colouring was changed at the beginning and end of musical sentences or phrases for variety’s sake; although no “colour-sound-theory” was relied upon, pianissimo passages were usually in mutes hues, and fortissimo passages in highly saturated contrasting hues. (McLAREN, 2006, p.58).

Moreover, it was also important the colours to match.

In *Blinkity Blank*, silence and music mirror the darkness and brightness of the image, respectively; when the silence was “disturbing”, there is the use of reverb (specially on the animated sounds) as it is done in *Mosaic*. In *Begone Dull Care* it is the density of the music that presents a directly proportional proportion to the use of colours, in other words, the bigger the amount of musical notes, rhythms and different tones, the more colourful the film will be. In this works it is also possible to associate the visual shapes to the musical instruments (when it is observed the sync between the same sounds and images). Thus, in the first part of the film, the piano tone is associated to the
appearance of abstract shapes and lines that move upon the background according to the rhythm of the instrument (see figure 3); the tone of the contrabass is associated to the appearance of black abstract shapes upon the red background (see figure 4), also following the rhythm of the instrument; and the drums is associated to the appearance of more figurative shapes, as it is shown on figure 5, however it is not limited only to it. There are always drawings of abstract shapes for the gestures made by the drums.

**Audiovisual object**

In movies the image does not make a clear reference to the everyday things, to the memorized visual experiences, the abstraction requires other interpretative processes, the immediate sensuousness of the relation between image and music becomes even stronger as a key of the viewer's relation with the film. Without the associations already existent on the world, the viewer starts to seek for meanings in a more equal way, both in the image and in the sound. On his works, McLaren created “audiovisual objects”3, film in which sound and image are joined to the point it is not possible to separate them. Moreover, the relationship among the perception modalities is so complex the senses are confused, in a transensoriality – an overflow of the boundaries of listening and vision, simultaneous events causing the dis-differentiation of the senses. Herein, the sense of the audiovisual work no longer is articulated in terms of a narrative flow of references. The story is diluted in temporal developments, on a flow of audiovisual material which is organized in blocs, patterns, themes and variations of relations of image and sound that afford a narrative – a consistent flow – that gives unity to the film.

The articulations that use simultaneously the sync with some translational model – even it does not have a representative logic easily identified – acquire a unifying force that smudges the division between the signs. Seeing has so many relations with hearing that an audiovisual object is emerged. Here, Chion's notion of sincresis (Chion, 1998, p. 65) acquires a different force beyond the simple synthesis allowed by the synchronism conceived by the French author: the unifying force of the audiovisual object also comes from a formal bond between image and sound.
Figure 4: Four frames from Begone Dull Care. The abstract forms follow the gestures on the contrabass. Print screen.

Figure 5: Two frames from Begone Dull Care. The pictures appear along with the drums. Print screen.
Conclusion

Most of the aesthetics of Norman McLaren's works comes from intuition and transensorial ability of the animator. Through the audiovisual medium, he expressed what he had heard and felt. The shapes and sounds he made had a synchronic articulation and, at some points, even redundant, a model of relationship based partly in unconscious cultural patterns, which one learns and absorbs from where one comes from. If the sync and some formal co-relations already found support in the visual, musical and audiovisual repertory, some translations shown by McLaren are complex and original. The transensorial ability of the animator makes it difficult any concrete analysis about some articulations between sound and image. Without the animator's testimony, many of his audiovisual proposals cannot be ever unveiled, they already happen in a degree too particular of the author and such relations differ from person to person.

If on one hand the intuition of Mclaren is a creative source and subjective, on the other hand the animator reproduces what he usually see and thus he reinforces the use of some patterns culturally already accepted – those patters were already in the end of the 1930's common solutions in the Disney movies – as to use a sequence of ascendant and descendent musical notes to sound the movements of rise/appearance and fall/disappearance of some objects, respectively (patterns widely used in Neighbours, for the appearance of the flower, the setting of chairs, the appearance and disappearance of the fence and the neighbours' tumbles while they fight) and the use of “trembling” shapes when some instrument makes a tremolo or a granulated sound (as the vertical lines that follows the main melody in the middle of Fiddle-Dee-Dee, de 1947), which refer to what one can see in the image.

Besides the solutions to translate, recognizably, image into sound and sound into image in other filmmakers' works, McLaren surprises us with a composition of audiovisual objects. In other words, even though many times the constructed strategies of some audiovisual object is founded in known solutions, it is the composition of these objects plus sophisticated solutions that generates the vitality of the films. The minimalist aesthetics of McLaren can be another source of the simplicity of solutions, likewise it leads to the economy of shapes and colours. However, the animator in his works starts from the clear and didactic exposure of an idea, theme or simple motif to develop this material, until the complexity during his animations: the minimum to produce the complex.

It is undeniable that Norman McLaren had consciousness of the potentiality of the audiovisual object proportionated by cinema and that he knew how to use it, in both simple (even didactic) and complex manner. His works provide poetic audiovisual objects “to see through the ears and hear through the eyes”.

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The significance of sound in Norman McLaren's films

VISUAL MUSIC - MODERNISM OR POSTMODERNISM? AN ARTIST´S PERSPECTIVE

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Abstract
Visual Music can be briefly described as “paintings” with motion. The imagery is usually abstract and deeply connected to the music. It has attributes of both modernism and postmodernism. It is modern in its simplified forms and in its craft ethics. It is postmodern because of its impurity, fusion of sound and visual, and in its use of the simulated 3d space. It is also postmodern in regard to the multiplicity of possible meanings. Although, in the lack of an intended “message” it does not adhere to any of them.

Keywords
Visual Music, Postmodernism.

Introduction
When Maura McDonnell (McDonnell, 2010, 1) wrote: “Visual music does not reference anything beyond itself” she made it clear that Visual Music is somehow deeply apart from today’s mainstream art, in our interpretation. How could one reconcile the avant-garde aura of Visual Music with this apparent detachment from what is seen in any gallery? Here we share our view of this problem, in an artist’s fashion. This is not carefully grounded or extensive as an academic work; it is much more a stepping stone process, frequently used by artists trying to navigate into the complexity of today’s art. For any reference about Visual Music definition we rely on McDonnell’s 2007 and 2010 papers.

Discussion
Beside all that has been written about postmodernism, it’s clear that to go to any biennale today, one needs an explanation about what will be seen. It is naive to look for beauty. The public should be explained about each piece, in order to know what the artist means. It seems that an implicit text is demanded (see for example Ashbee, 2009, 1) - and then comes a prolific academia to fulfil whatever was missing. Postmodern art demands scholars and teachers, professional art connoisseurs,
to be fully understood by the audience. It seems clear to us, that it is a sort of fusion between visual art and words, left and right brain thinking.

How could a sound based art form\textsuperscript{13} fit inside the 21st century verbose postmodernism? Will it be possible to start a “ménage a trois”, music, image and text for this kind of art? When Visual Music was born as abstract cinema in the 1920’s, its identity was partly established by being different from narrative cinema - the art form that became immensely popular in the 20th century. After 1965 with Paik and others, video technology was shown to be a great tool to what many of postmodern artists were looking for: impersonal social commentaries, humor and a way to show politically striking images (Rogers, 2013, 2671). Video Art becomes one of the most representative postmodern art forms. Therefore, Visual Music has not a big space to maneuver: if a narrative comes it will be like cinema; if mute social commentaries are made it will be indistinguishable from Video Art. So, in our perspective, Visual Music will lose its very identity if it flirts with words - it will be just one more kind of Video Art. Hence, it makes more sense if it keeps the abstract speechless character set by its 1920’s German pioneers, avoiding the postmodern political web of references.

Does that mean that Visual Music is not postmodern? Is it a step to the future or to the past? As the highest priest of modern art, Clement Greenberg (Greenberg, 1986, 85-93) preached, any art should be absolutely restricted to its unique medium and “Purity becomes a guarantee of quality”. Visual Music is fusion, it is synesthesia, it is the ultimate mixed breed. The visual by itself is (frequently) not just 2D but also has a “fake” three dimensional structure. The depth is part of the space where the dynamic occurs. Most artists don’t care about an exclusive use of the actual two-dimensions of the television (or screen), because the art is not made in this surface anyway. Therefore, in regard to its impurity, Visual Music is postmodern.

However there are other attributes of Visual Music that set it inside postmodernism. It is a well-founded idea that Television is an essential part of the postmodern ethos, for reasons irrelevant for this article. But for us, it seems clear that a byproduct of the cultural importance of TV for those born after 1960 is that they get used to moving images. They feel a painting is artificially static, something important is missing. Both today’s practitioner and his audience were born under the TV age. This public is indeed starting to envision a TV set to show art, as a frame, inside their homes. Therefore, the very acceptance of Visual Music as an art form can be inserted in the postmodern process.

There is also a third concept that links Visual Music to postmodernism, although this comes

\textsuperscript{13} There is Visual Music without any sound but it is unusual.
to an evaluation of our work, but it can’t be generalized to every work developed today. Recognizable forms can be seen in some Visual Music pieces. How to reconcile that with the lack of outside references? What lacks in Visual Music (in our view) is intended meaning. The postmodern artist feels successful when, for example: he or she intends to make a commentary on the patriarchal family decadence and set an empty table and chairs; his public feels something about family or emptiness. In Visual Music the table and the chairs will be spinning and when they superpose the image will resemble an elephant (for example) or whatever image, but that was not planed. It is like seeing forms in the clouds. The public sees an image that is not a “message”, the artist didn’t even think about elephants when creating it. And that resembles the ideas developed for literature by Roland Barthes in “Death of the Author” (Barthes, 1999, 383-396). It would be impossible to share a meaning in Visual Music because different people could be “seeing” slightly different times, see example in Figure 1; highly dynamic images would be rendering absolutely different forms. Therefore in this sense Visual Music is postmodern, it is up to the public “see” things, which significance is personal, but there is none of the implicit message from the author (or its translators) usually found on postmodern art.

On the other side, Visual Music has a strong adherence to Modernism. A brief look at Kandinsky and Klee and it seems that Visual Music is just modern art empowered by technology. In 1914 the abstract painter Léopold Survage applied to a patent of "symphonies en couleur", envisioning content and technique. Calder not just pioneered kinetic art in the west, but through his commentaries about it, opened the mind of the next generations of artists to extend the relevance of motion in visual arts. "Just as one can compose colors, or forms, so one can compose motions" is an example of his thought about kinetic sculpture that perfectly fits a Visual Music work. An even more radical interpretation of this theme was proposed by Michael Betancourt (Betancourt, 2006, 1): instead of a parallel development between abstract cinema and modernist painting he proposes that synesthesia experiments and concepts (started in the XVIII century) were important to bring out the abstractionism that was so important in modern painting.
Figure 1: Three frames from 2013 ALTERA’S Visual Music work RHEOTAXIS showing different possible sights in the same sequence. The white drawing was layered over the actual images to show what can be seen in those instants that are a few frames from each other.
Visual Music has also a second aspect that is still somehow associated to modern art, especially sculpture: the artist should rely on technical mastery and the craft is relevant. From renascence until modernism the artist was highly trained in his (or her) craft and had a deep knowledge of his medium. The postmodern artist “plays” with different media and regards its ideas more import than his (or her) technique (Hopkins, 2000, 67-94). In its very beginning Visual Music was thoroughly connected to the idea of making apparent motion from the frame-by-frame images and some pioneers indeed draw it that way. It involved a vast amount of work to produce a few minutes and that was accepted by the Visual Music pioneers until the advent of computers. The same way a stone sculptor cannot produce at the same pace of a painter and should know that his lifelong work will count less in numbers, a Visual Musician had to make each work count. Today with the advent of computers it is possible to make hours of low quality work but it does not change the old truth that to really master the art one should know the craft - that today means to understand the details and moods of computer software. Maybe not all the artists working with Visual Music today, but many of them still have a strong connection to the art process, and many of them still develop his (her) tools. Scott Draves is a remarkable example on that. The old-time truthfulness to the medium was perfectly relocated to the digital medium. To produce something new one has to accept the huge amount of work demanded and that pieces will come in years, not in days.

**Conclusion**

Postmodernism by its very nature includes diversity. It does not even exclude a contemporary modernism that would be part of the Visual Music nature. Postmodernism implies an “end of (art) History”, as trends coexist. It is deeply different from the art history taught before where dominant styles resembled hegemonic empires of the human history. Postmodernism looks like a soup: everything is boiling inside it. The trend can be noticeable over the surface or unfashionable deep in the pot. For now, Visual Music and Video art seems to be lying close to the bottom while New Media is hype. Many big names that used to work with installations are now doing video and we guess most of them never heard about Visual Music. It is not clear if Visual Music will resurface as a movement or the postmodern boiling will let only individual artists without a collective unit worth a label.

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FROM DIGITAL HARMONY TO CHROMOPHONIA: CONTRIBUTIONS TO VISUAL MUSIC DEVELOPMENT

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Abstract
This paper approaches two artists who developed work in the domain of sound and light, which depart from different artistic experiences and backgrounds to propose fruitful theoretical ideas to the field of visual music. First one is American experimental film maker, and pioneer of digital video, John Whiney Sr., who developed a personal theory of digital harmony between sound and light, and a groundbreaking conception of their complementarity; second is Brazilian composer Jorge Antunes, who also developed an original theory relating sounds and colors, supported by exquisite research findings and pioneer compositional work.

Keywords

Introduction
Well known to most artists who reclaim to practice visual music is the name of North American experimental film-maker and digital video pioneer John Whitney, Sr. (1917-1995). Through more than four decades of ceaseless aesthetic and technical research and experimentation – in which he's been accompanied, fore sometime, by his younger brother James (1921-1982), John Whitney has not only developed an original and nowadays highly acclaimed art production, but has been able to fully formalize concepts which have important consequences for the field, such as digital harmony and complementarity. Not so well known in this field, both for his belonging, in most of his lifetime effort, to the field of avant-garde music, and for being an artist from a country usually not considered when it comes to synesthetic art narratives, is Brazilian composer Jorge Antunes (1942-). Although also highly acclaimed by his peers, Antunes singular theory of Chromophonia is also not only original, but in itself a relevant contribution to the field, dealing with problems Whitney's theory do not touch, and offering much probably more radical harmonic openings.

John Whitney's groundbreaking contributions to visual-music theory
One of the first artists to formally reclaim the concept of visual music, American experimental film-maker John Whitney, Sr., also a pioneer of digital video, has an almost legendary status to this considerably young art field. Although his younger brother James' films may have established a striking standard of abstract-synesthetic-psychedelic sound and image synthesis – to the
point that John may have himself declared that his own carefully developed methodology of work wasn't but a strategy to make James' films without the insane amount of artisanal work involved –, the elder Whitney's efforts to formalize both theoretically and practically, through dedicated software development, his ideas towards the field have reached groundbreaking conceptual level, and achieved a unique – if not unrivaled – concept of "complementarity", based on the principles of his "digital harmony". It is thus interesting, 20 years after his death, to make a brief re-evaluation of John Whitney Sr.' legacy. Given the brief space of this paper, we'll consider here some aspects of his theoretical contributions, leaving an analysis of his amazing artworks as an enterprise to be undertaken a next time.

I may be most probably uninformed of many amazing things that are being done now around the world, as the amount of works produced in the last decades in this field is probably impossible to fully inventory. Digital technology, for a number of reasons – which are not solely technical – came to fulfill a demand for technical tools able to the simultaneous crafting of images and sounds as none technique before has been able to (BASBAUM, 2002, 2013). Successful pre-digital attempts to bring together colors and sounds must be credited maybe to Wallace Rimington, Alexander Scriabin, Thomas Wilfred (PEACOCK, 1998), Oskar Fischinger and his Californian heirs, the Whitney brothers, John and James, and Jordan Belson (MORITZ, 1986), for example. Among those, John Whitney, Sr., is the one who has been able not only to produce artworks in a larger scope of formats, but also made theoretical attempts to share conceptual ideas that both evolved from practice as it emerged from them. The hypothesis I call differential harmony derives from the idea that progressions of ratio in visual as well as tonal (chordal) patterns of harmony lie at the heart of our perception of time as aesthetic structure. (WHITNEY, 1994:48).

Driving from the perceptual theory of sound gestaltist Victor Zuckerandl, Whitney sustains that our experience of time is not structured by patterns of rhythm in itself, but by the way harmonic movements of tension and release – just like those developed in 400 year of tonal harmony:

I observe that action between a dancer and the music or a conductor's gestures demonstrate that the thrusting, driving ratios of harmony possess a visible component of resonant tension. Harmonic perception is an innate fact of life. (WHITNEY, 1994:48)

Thus, the core belief at John Whitney poetics is that archetypical mathematical relations which evolved into chord forms in Western music could be expanded to the domain of image through the movements of pixels in computer screen, creating a digital harmony in which

Audio, and now visual, progressions and transfigurations generate sometimes
striking resonant forces. These are the forces that form the headwaters of great rivers of emotional power that one enjoys with music. Without this structured ebb and flow of harmony, all else is merely drumming. Yet, drumming demands tuned drums (WHITNEY, 1994:49)

Whitney claims for a synesthetic synthesis of sound and color as a step turned possible by the command over pixel movement in computer screen, which allows the composer to work – through his own dedicated software – in the simultaneous crafting of sound code (in his case, through MIDI commands, the technology available at the time) – and pixel movement code, designing patterns of visual-music beauty unknown to his date. As a result, he can digress about his notion of sound and light work as painting on water, "The audiovisual duet of Complementarity". As I've noticed in previous work (BASBAUM, 2002:104-11), though seemingly plain, John Whitney's notion of "complementarity" must be recognized as groundbreaking concept in the field of visual music, considering that everything that has come before his works shall be understood as images superimposed over sounds – as in the typical examples of Fischinger or Wilfred (MORITZ, 1986; PEACOCK, 1998) works. Or, in the case of Harry Smith's abstract films, sounds covering abstract images. Interestingly, Whitney's carefully designed and programmed system does not define any relation among colors and sounds, keeping the use of colour as an unformalized territory in his creative methodology. Also, one should notice that all mathematical relations between sound pitches that have allowed the fantastic development of Western music tonal harmony from the XVIII century on, owns to adjustments of pitches demanded by tempered tuning. By observing this, one should take in account that musical development in the whole pianoforte era cannot anymore reclaim an essential, absolutely Pythagorean mathematical relation to the physical nature of sound, but must concede that Western music is marked by cultural codes even beyond 12 tone scales. That is: to fully reach the absolute spiritual level reclaimed by Whitney, we should get back to modal music tunings and give up harmonic tonal modulation.

**Jorge Antunes: Synesthesia art pioneer and Chromophonia**

As we just mentioned, John Whitney has chosen not to establish a fixed relation of colors to his works. To find contemporary a theory of sounds and colors correspondences, we have to drive south. Quite on the other side of the Americas, another artist with synaesthetic claims has developed a carefully crafted theory of the relations between these domains of sensory experience. Not aware of the so called Californian "visual music" esoteric circuit, and probably not aware of the deeply synesthetic character of Olivier Messian experience of sound (see SAMUEL, 1986), Brazilian composer Jorge Antunes, departing from childhood experiences with painting and a passion for music
– plus a passion for science and electronics – has proposed an original theory about the relations between colors and sounds which has been practiced in several of his compositions. While his main creative territory has come to be music, in the formally opened and quite experiential and experimental cultural environment of the 1960s, Antunes was not only the very pioneer of Electronic Music in Brazil, but also a pioneer in installation art (KUBOTA, 2002). In fact, his installation *Ambiente I*, which presented multisensory elements, designed to stimulate "all human senses" (ANTUNES, 1982) has been staged in Brazil prior to the nowadays well known Helio Oiticica's *Penetráveis* – artworks that gained worldwide recognition as opening directions for contemporary art. If it is certainly not the case of questioning the aesthetic power and the impact of Oiticica's installations and their relevance to contemporary debates on the transformative possibilities of aesthetic experience, it is also not the case to undervalue the creative courage of the young Jorge Antunes to devise and present a kind of work of art never done before at this time, and which even couldn't have then a definite category to be included in and interpreted. Describing this work, Antunes has labeled it as "synesthetic", which was also unusual at the time. However, Antunes official career in the so called "visual arts" or "fine arts" field was resumed to this and other few works exhibited in those young-artist years, and his creative energy has been directed towards musical composition, a territory in which he's become one of the main avant-garde composers in Brazil (see ANTUNES, 2002).

Nevertheless, Antunes synesthetic drives weren't left behind. Already in his formative years, he's developed his own pioneer *Chromophonic* theory, in which precise relations among colors and sounds are deduced from well defined criteria (ANTUNES, 2002). Departing from a description of acoustic properties of vibrating systems, Antunes notices well known particularities of octave relations in Western scales, in which a certain definite pitch, say, a C, is again named C when its original frequency is doubled. Thus, if you have an A=440hz, when you have a string vibrating at 880hz, this sound, in our musical culture, will be named A again. This gives us a typical Western compositional scope that traditionally divides the range of frequencies from 16 to 20.000 hz in several chromatic scales of 12 semitones. Our whole musical tradition has been built over this chromatic material, submitted later, in the XVIII century to the so called "temperament", which liberated composers to freely change key registers and develop complex tonal – and later atonal – harmonic games. It is but an almost natural speculation that if we raise octaves above this sonic range, by doubling frequencies several times (42 times, to be exact) one will meet a different kind of sensible phenomena, perceivable through our eyes, which we call light. Over this octave relation, Antunes has
built his own Chromophonic system, supported by several findings which underline the original aspects of his proposition.

Figure 1. Original chromophonic pitch to color correspondences, with light frequencies (Hz): $E = \text{infra-red}; F = \text{infra-red}; F\# = \text{red}; G = \text{red}; G\# = \text{red-orange}; A = \text{red-orange-yellow}; A\# = \text{orange-yellow}; B = \text{greenish-yellow}; C = \text{green}; C\# = \text{greenish-blue}; D = \text{blue}; D\# = \text{violet-blue}; E = \text{blue-violet}; F = \text{violet}; F\# = \text{ultraviolet}; G = \text{ultraviolet}$. These are the frequencies of the basic piano pitches ($A1 = 440\, \text{Hz}$), times $2^{13}$ (or $2^{14}$). Notice that this octave projection of frequencies defines a precise octave cycle in the light spectrum. (ANTUNES, 1982: 29)

Needless to say, Antunes, who's a degree in Physics, is well aware of the differences between sound and colors as material phenomena. Sounds are mechanical waves; colors are at the same time wave and particle. Thus, the later ones cannot be simply turned into the former by lowering their frequencies, and vice-versa. This is not, however, what Antunes proposes. The relation he establishes does not take place in the material phenomena of sound and light, but in psychology of its human reception. By taking into account the resonance provoked through sympathetic vibrations – the same which make related harmonic strings vibrate spontaneously in a piano forte, especially when you liberate them to vibrate through the use of footpedal (see, for example, SCHOENBERG, 1983) –, Antunes suggests that optical and acoustic nerves may resonate one with the other, so that pitched sounds give rise to color sensations akin by an octave relation. Newton had noticed, two centuries before (BASBAUM, 2002), that such octave relations would project a precise octave in the light spectrum, from $C$ to $B$. By making his own tables, Antunes finds a similar range, except that the lower color in visible spectrum, red, corresponds, by mathematical octave transposition, to $F\#$, his own range coming higher until $F$, violet.
As I have noticed before (BASBAUM, 2002), several composers have proposed their own tables of correspondences before Chromophobia. In his own book, Antunes shows several tables proposed by well known composers, such as Rimsky-Korsakov (ANTUNES, 1982), a master of colorful orchestration. To support the claim that his own table of relations, derived through mathematical calculation, reaches a more essential level, Antunes offers two surprising findings. The first of them is the comparison between his table and a table of correspondences between colors and sounds presented in private esoteric papers of the Rosacrucis Order. The Rosacrucis table (fig.2), which present their correspondences as spiritual secret knowledge of vibrational aspects of universe – with an assurance typical of esoteric sects – is, in fact, strikingly similar to Antunes, with small a difference that can be blamed to a different tuning of A (327hz). It must be recognized that, Antunes, moved by a spirit of scientific inquiry, somehow touched unexpected spiritual and religious grounds.

However, besides spiritual aspects which can be – as we have noticed in several writings (for example, BASBAUM, 2013; or BARBOSA, 2007) – a recurring trace of most synesthetic poetics, Antunes most amazing finding – his favorite (as confirmed by himself in recent email exchange) – is the striking similarity among the experience of complementary colors and the perception of the pitch interval of 5ths:

As professionals that form and conduct amateur choirs, and that take part in tests and selection of amateur singers, know, we are used to find individuals who confuse the sounds that constitute a perfect 5th (…). This lack of ability to distinguish between, say, a C and its perfect 5th, a G, has an analogy in visual perception: Some
Daltonians are unable to distinguish red from green. Well [in the proposed table], \( G \) corresponds to red, and to \( C \) corresponds green (Antunes, 1982:30).

If it can be said that pitches are directly proportional to brightness, and inversely proportional to volume (in spatial terms) (see Marks: 1978, 2011); or that images create an illusion of movement in approximately the same frequency in which sounds cease to be perceived as pulse, to be perceived as pitch (aprox. 16hz); then, Antunes finding, in what relates to psychology of perception, establishes another domain of common ground for both modalities.

Antunes Chromophonia establishes a fixed ground of relations between colors and sounds – one that has, as we've noticed, spiritual consequences implying some kind of absoluteness in their correspondences – but this is also, somehow, contradictory with ever changing demands of evolving avant-garde music possibilities, in terms of aesthetic development. On the other hand, his theory, crafted in a post-cagean era of contemporary music, offer ground for endless plastic dealings with the so-called post-tonal and post-electronic musical harmonic possibilities, as his compositional work has been demonstrating so many times.

**Conclusion**

Representatives of different schools of art, in the North and South America, John Whitney Sr., and Jorge Antunes have managed to produce both artworks and theories which offer relevant and inspirational material for artists dealing with the still maturing field of visual music. In fact, both conceptions have played a key role in the definitions of my own Chromossomnia (Basbaum, 1996, 2002), which aims both the chromatic command offered by Jorge Antunes Chromophonic theory (on which it was initially inspired), and the non-hierarchical properties presented by John Whitney's Digital Harmony – overall, his notion of complementarity.

As we have noticed, those great artists do not escape, however, the unavoidable contradictions embedded in any formal system (including mine, that's for sure): while it seems to me difficult to reconcile a radical avant-garde position, like the one advanced by Antunes in most of his work, with absolute correspondences derived from spiritual levels – that is: the notion of evolutionary aesthetics claimed by avant-garde composition does not sound to completely comfortable, though not excludent, with immutable aethernal veritatis –, it also raised questions concerning Whitney's harmonic conception, and its presuppositions, of natural beauty harmonic relation. After all, one of the greatest achievements of avant-garde art, in general, and in all its forms, has been an ever changing notion of the possibilities of beauty.

This said, and post to debate, one certainly has to acknowledge the amazing creative power
and energy, the dedication and inspiring legacy those two amazing artist have given to artists who are now working with the new challenges of visual-music creation.

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CONNECTOME DATA DRAMATISATION: THE HUMAN BRAIN AS VISUAL MUSIC

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Abstract
We, as a collaboration of scientists and artists, have built a visual and sonic representation of highly connected areas in the human brain. This model was developed to not only be a tool of scientific research but also a tool for art creation. In the process of developing the software, the tool was built to interface with musical instruments for real time visualization and sonification. Working conceptually with the idea that scientific data can be repurposed for art creation, the Connectome is performed as both a sonic and visual representation of fMRI data, manipulating the model in real time as a form of multimodal data dramatisation.

Keywords
Sonification, Data Visualization, Visual Music, Max/MSP, Unity

Introduction
Partnerships between artist and scientist allow for creative forms of collaboration that can push both scientific and artistic research. With the Connectome Data Dramatisation project, our principal interest was in the creation of a hybridized tool, one that could work as both as a scientific research tool as well as artistic work. Beginning with a dataset that consisted of measurements of functional connectivity (obtained at rest in a group of healthy young adults) between 441 neural bundles (brain areas) or nodes systematically differentiated into 21 systems of interest in the human brain based on fMRI data collected by one of us (Gagan Wig) as part of the work of the UTDallas Cognitive Neuroimaging Lab.

Our team was able to extract visual and sonic representations of the connections between those areas using custom software. We then developed that representation further in the form of an interactive three dimensional node edge graph and sonification of the 441 highly connected areas of the brain (in the case of the visualization, the width of the edges).

Collaborators: Sruthi Ayloo; Micaela Chan; Scot David Gresham Lancaster; Roger Malina; Tim Perkis; Neil Savalia; Maximilian Schich; Anvit Srivastav; Gagan Wig

Area of interest in this case were areas of concentration of neurons in the brain as identified by researchers at of the Center of Vital Longevity, Cognitive Neuroimaging Lab at the University of Texas at Dallas. http://vitallongevity.utdallas.edu/cnl/ accessed march 7 2015.
This would form the basis of the representation. With the addition of the ability to activate nodes from external data feeds via Open Sound Control\(^\text{16}\) different nodes could be excited at will creating a virtual, three dimensional instrument that could be used for visual and sonic performance. Using four small drums, the visual and sonic representation of connections between areas of the brain can be played in real time. Custom software receives input in the form of audio signal from each drum and excites specific areas of the brain. Each section of the brain that is played will present a unique visual and sonic representation.

**Design and Usage**

The system was initially designed using Max/MSP and had three primary components. The first was in the retrieval of raw sound from the drums and the conversion into usable data. For this we used piezo microphones attached to drumheads, that signal was then sent via xlr cable into a MOTU 896 mk3 which allows for up to 8 microphone inputs. The MOTU microphone feeds are then analyzed in Max/MSP with the Berkeley CNMAT\(^\text{17}\) analyzer~ object for threshold detection in the incoming audio. This gives a very accurate hit detection from the incoming audio. The second component is the data parsing done within Max/MSP. Principally using the dict object, we had taken our dataset consisting of approximately 77,000 connections and formatted it using Microsoft Excel adding a JSON structuring to work well with the dictionary object within Max/MSP for accurate and fast parsing of the data set. The third component of the software architecture is the real time rendering

\(^{17}\) [http://cnmat.berkeley.edu/downloads](http://cnmat.berkeley.edu/downloads) accessed April 24 2015
in OpenGL\textsuperscript{18}. Once we were able to extract the precise data of any given node within the data set, we were then able to draw lines from the initial node to each subsequent connected node in three dimensional space. The advantage of this modular architecture is in the replacement of components for prototyping and development. For instance, over time we wanted scalability and mass distribution and found that we could do the parsing and rendering with Node.js on a heroku web server. By doing so we could leverage the strength of node with large scale distribution while using the same overall design and architecture. At the same time webGl\textsuperscript{19} presents it is own bottlenecks and that component can be replaced with the Unity game engine with ease with it is advanced rendering abilities because of the modular nature of the software. The current version of the on line tool can be accessed at http://threejs-app.herokuapp.com/

**Historical Perspective**

Building on previous explorations in bridging art and science through the development of new technology, we were actively looking to understand how this project is situated within the history of visual music. In looking at the work done at Bell Labs in the 60’s and 70’s\textsuperscript{20} and with the work of artist such as James Whitney\textsuperscript{21}, the question emerges, what are the components of a successful art and science collaboration? How do separate practitioners collaborate while furthering each of their own research? Phill Mortin and Dan Sandin’s image processing units\textsuperscript{22} also played a role in both the conceptual development as well as the technical development of the work. How is information shared and disseminated after it is creation? Other contemporary artist were looked at as well including the work of Noisefold\textsuperscript{23} in their sound extraction techniques form visual information, Ryoji Ikeda\textsuperscript{24} in his visual and sonic representation of data, Semiconductor\textsuperscript{25} in their blending of art and science amongst others working with visual music as a contemporary practice as well as Chris Chaffee’s Brain Stethoscope\textsuperscript{26} in the sonification of fMri data. The brain in particular is exquisitely complex and of

\textsuperscript{18} https://www.opengl.org/ accessed April 24 2015  
\textsuperscript{20} http://www.ieeeeghn.org/wiki/index.php/Archives:Bell_Labs_%26_The_Origins_of_the_Multimedia_Artist accessed March 7 2015  
\textsuperscript{21} William Moritz on James Whitney's Yantra and Lapis http://www.centerforvisualmusic.org/WMyantra.htm accessed March 7 2015  
\textsuperscript{23} http://noisefold.com/ April 24 2015  
\textsuperscript{25} http://semiconductorfilms.com/ April 24 2015  
\textsuperscript{26} http://news.stanford.edu/news/2013/september/seizure-music-research-092413.html April 24 2015
no doubt the muse of many artist and scientist. In particular, works like Chaffee’s Brain Stethoscope and Hearing Music of the Hemispheres by Maria Chavez27 are of a similar subject matter but from a very different perspective. While we start with the raw fMRI data, we further abstract the data in a process of macro level interpretation of important brain areas while the brain is at rest.

Visual music has been historically tied to the development of technology. This holds true now as much as it has in the past. Current rendering technologies are evolving rapidly within the gaming community and practitioners of visual music are greatly benefiting from real time rendering advancements within the gaming communities. Robust community support and the indie gaming movement have provided new tools for interfacing with gaming environments28. Two areas that are underdeveloped with regard to these environments and practitioners of visual music can provide insight are in the development of procedural animation, and the assimilation of data into these environments. With this project we have begun to build a framework that can both provide a series of procedural animations with regard to node edge graphs as well as interface a gaming environment with a dataset of approximately 77,000 connections. In doing so we have tried to maintain the work as both a piece of art and a scientific instrument.

Future Work

In the process of building this project, we have worked with many technologies to find the right combination of frameworks and development to allow for extensive flexibility in artistic representation of the data set. We have worked with Max/MSP Jitter29, Unity30, Syphon31, Three.js32, node.js33, midi.js34, coffee collider35 and D3.js36 in an exploration to find what technology would serve the representation of this dataset best. Beginning with a representation using three.js hosted on a node.js server we were able to bring in live data via OSC to trigger the model. We found ultimately that building everything in the web browser provided great accessibility for global use of the tool, however, confining the project to the web browser also creates limitations with regard to power for rendering and audio synthesis. We have built a framework that now uses the Unity game development

27 http://scalar.usc.edu/anvc/music-of-the-hemispheres/read-the-article April 24 2015
29 https://cycling74.com/ accessed March 7 2015
30 http://unity3d.com/5 accessed March 7 2015
31 http://syphon.v002.info/ accessed March 7 2015
32 http://threejs.org/ accessed March 7 2015
33 https://nodejs.org/ accessed March 7 2015
36 http://d3js.org/ accessed March 7 2015
environment specifically for it’s strength with regard to real time rendering and are working on integration of Pure Data\textsuperscript{37} via the Kilimba Unity extension\textsuperscript{38}. This process will allow us to build a platform addressing the two primary areas of dataset integration into gaming environments and procedural manipulation as well as sonification and visualization of said dataset.

**Summation of Findings**

The creation of the Connectome project has led to some interesting further work in collaborations between artist and scientist. Beginning with the fundamental question can scientific instruments be used as tools for art creation and can artist tools produce scientifically valid results, our team was working to further a dialogue between artist and scientist while creating real value for each party involved. In doing so we have opened up another path of exploration in the form of using game development platforms for data visualization and sonification as well as the reappropriation of these platforms for use in real time audio visual work. By creating a core representation, we were able to build a model that could be manipulated in real time using incoming Open Sound Control data and provide a scientifically accurate representation of the underlying dataset.

\textsuperscript{37} [http://puredata.info/ accessed March 7 2015]
\textsuperscript{38} [https://github.com/hagish/kalimba accessed March 7 2015]
Abstract
This paper discusses several approaches to the concepts of transdisciplinarity and visual music. Transdisciplinarity is addressed as a scientific research principle, as an epistemological strategy, as an instance of discipline integration and as a category for digital art. Then a personal approach of transdisciplinarity as a fundamental, multi-feature characteristic of contemporary artworks is proposed. In a corresponding way, visual music is addressed as a discourse progressively built on musical, audiovisual and multiple-level conceptual grounds. Then visual music is proposed as a key concept that has been locally and historically defined, and conveys a great potential to operate as a bridge to get music art professionals closer to transdisciplinary artistic production.

Keywords
Transdisciplinarity, visual music, interdisciplinary displacement, digital art, contemporary art.

The quest for transdisciplinarity
The reason transdisciplinarity is used as a guideline for a paper on visual music comes from a 10-year experience of the author as a teacher for the National Center for the Arts (CENART) in Mexico City. A key role of this institution is conducting a transdisciplinary academic program for artists, active since 1994, that brings together students from the schools of visual arts, music, film, dance and theater under the administration of the National Council for Culture and Arts (CONACULTA). The most recent and complex project on this academic scope is the Tránsitos diploma program.

Tránsitos started in 2008 as an academic initiative for artistic research, experimentation and production from a transdisciplinary perspective. Tránsitos professors, known as coordinators, are in charge of multiple-discipline-subject, six-month-long workshops called nodes. In addition, they participate of a weekly meeting seminar for open discussion on the academic program and on proposals for its improvement, called Tópicos problemáticos en la cultura moderna. Tópicos seminar attempts to establish an extensive and singular basis for Tránsitos operation (Andión, 2012, p.17-21), therefore a quest for the transdisciplinarity, its form, its nature and its emerging conditions becomes a common place every week at Tópicos sessions.

Building a common definition of transdisciplinarity, decided and agreed by all coordinators, is one of the most active and controversial topics of the seminar. In spite of the substantial time collectively spent on this purpose, there is not a definite, valid-for-everyone definition of
transdisciplinarity yet. However, this situation results in a valuable diversity of points of view that have proven to be a very useful resource for Tránsitos complex operation. Instead of a single definition, there is a definition field enclosed by a set of constant coordinates and enriched by some uncertainty. Constant coordinates are given by a conceptual framework which is valid for all coordinators, while uncertainty comes from the particular reading each coordinator makes on the framework. As an essential part of this didactic mechanism, four approaches to the concept of transdisciplinarity discussed in Tópicos are summarized below. Then the author's personal approach, transdisciplinarity as a central category for contemporary art, is presented.

**Transdisciplinarity as scientific research principle**

In this scope, transdisciplinarity is a principle for scientific research that claims to address a concrete problem in an extensive way, regardless the unitary approaches used by scientific disciplines that commonly deal with that problem. As a result, borders between disciplines blur and a more comprehensive and diversified understanding of the problem emerges:

Transdisciplinarity means that research is to a great extent in motion out of its disciplinary limits, that it defines its problems independently of disciplines and solves them by passing beyond these boundaries. The institutional expressions of transdisciplinary orientations -which are effective wherever a strictly disciplinary definition of problem situations and problem solutions no longer fits- are the new scientific centres that are being founded or have already been launched (...). These centres are no longer organised along the traditional lines of physics, chemistry and biology institutes or faculties but rather from a problem oriented perspective, which in this case follows the actual development of science. Transdisciplinarity proves to be a promising new research principle (Mittelstrass, 1999, p.96).

After addressing heat phenomenon and the heterogeneous collection of sciences that have studied it through history, Mittelstrass (2000, p.496) points out:

This shows that it is not the objects (alone) which define a discipline, but the manner in which one deals with them theoretically... This example from the history of science can be generalised so as to show that there are certain problems that escape the confines of a single discipline. Far from being marginal ones, these are often central problems, like, for example, the environment, energy and health. There is an asymmetry between the development of problems and that of disciplines, and this asymmetry is accentuated by the fact that the development of fields and disciplines is determined by increasing specialisation.

**Transdisciplinarity as epistemological strategy**

Max-Neef (2004, p.10), based on Nicolescu, summarizes this approach on a concept he designates strong transdisciplinarity, as opposed to a weak transdisciplinarity, a more practical approach for discipline integration that will be discussed later on this paper:
Epistemológicamente la transdisciplinaridad fuerte (...) se sustenta en tres pilares fundamentales: a) niveles de realidad, b) el principio del tercio incluido, y c) la complejidad. Además reconoce como modos de razonar simultáneos y complementarios, el racional y el relacional. La transdisciplina representa, por lo tanto, un claro desafío a la tradicional lógica binaria y aristotélica.

According to this approach there are different levels of Reality, and information flows in iterative ways between adjacent levels of Reality (the relation between classical logic and quantum logic is explained as a particular instance of these flows of information). While disciplinary research works exclusively on one level of Reality, even in only one fragment of it, transdisciplinarity works on the iterative, dynamic flow of information that happens in zones where different levels of Reality are adjacent. Max-Neef (2004, p.10-11) affirms that integration of different levels of Reality and a logic of the included middle derived from such integration set up a framework that allows a radical transformation of knowledge organization, in accordance with increasing knowledge complexity.

**Transdisciplinarity as a form of discipline integration**

As a result of the preceding discussion, Max-Neef (2004, p.10) proposes a *weak transdisciplinarity*, and describes it as “un enfoque práctico y simplificado, con vistas a permitir la aplicabilidad, para la investigación especialmente en las ciencias sociales, de un método que tienda a ser transdisciplinario”. By means of analogy between levels of Reality (*strong transdisciplinarity*) and levels of organization in knowledge disciplines (*weak transdisciplinarity*), the following classification of discipline integration schemes appears:

- **Disciplinarity**: Produces specialized knowledge isolated from other disciplines.
- **Multidisciplinarity**: Brings together several knowledge disciplines, but they do not share information.
- **Pluridisciplinarity**: Brings together several knowledge disciplines that share information with no coordination.
- **Interdisciplinarity**: Brings together several knowledge disciplines that share information under coordination of a discipline considered in a higher level of the knowledge structure.
- **Transdisciplinarity**: Brings together several knowledge disciplines that are organized in a multi-level structure and are able to share information under coordination of any discipline in the structure.

From this point of view interdisciplinarity takes place when, for instance, biology, chemistry and psychology are coordinated in accordance to objectives designed in medicine; or when chemistry, biology and sociology are coordinated in accordance to objectives designed in agriculture. Moreover, transdisciplinarity happens when all of the disciplines these two examples make reference to are
integrated in a structure that coordinates medicine and agriculture in accordance to objectives designed in politics or agronomics. In these examples the idea of coordination under a higher level discipline is valid because it is possible to think about this discipline as a knowledge field able to include a common axiomatic set for the discipline or group of disciplines considered in the lower adjacent level of the knowledge structure. In other words, when several knowledge disciplines organize themselves in order to serve another single discipline. This situation is specially interesting when knowledge disciplines are in fact artistic disciplines. From now, and according to a very specific musical research scope that will be addressed later, it is possible to think about visual music as an interdisciplinary operation which arises when painting, cinema, graphic design and animation are coordinated in accordance to objectives designed in music composition or music interpretation.

**Transdisciplinarity as digital art category**

Gibson, in Adams et al (2008, p.1) examines discipline integration schemes on specific digital artworks and associates these schemes with a transdisciplinary feature:

> Transdisciplinarity implies a level of direct connection and cross-over between mediums: the artist becomes the engineer, the engineer becomes the artist, and when they collaborate they actually have enough expertise in the other's field to be able to address concerns across the mediums and even across disciplines. This is not to say that there are not varying levels of expertise within transdisciplinary work, but rather that transdisciplinary art in its best sense makes the effort to understand the medium of the other in more than superficial terms.

According to Gibson, it is important to distinguish between this *transdisciplinary art*, which implies all collaborators make an effort to understand other participant's knowledge disciplines, and what he calls *interdisciplinary art*, an older artistic strategy where disciplines work isolated as a consequence of a poor understanding that collaborators have on other's expertise fields. It is also important to remark that, from the very title of their book, Adams et al think about the digital infrastructure as a preliminary condition for transdisciplinarity. So far Adams et al establish a concept of transdisciplinarity, which is imprecise and restricted to artistic production, where flows of information on the multiple-level knowledge structure of an artwork can only happen on two conditions: working on a digital communication channel and making an effort to understand other collaborator's language. At this point it is worth to remmark that, totally independent from the reading of this book, *Tránsitos* didactic mechanism was built, from its very beginning, in the quest for developing on students three skills strongly related to this approach: Flexible thinking, ability to use digital media and ability for team working.

**A personal approach to transdisciplinarity**
The four approaches previously reviewed comprise a theoretical core shared for all Tránsitos' coordinators. Now the author's personal approach to transdisciplinarity is discussed. It was presented for the first time as a part of Primer Encuentro de Arte Transversal: Diálogos Transdisciplinarios symposium, in May and June, 2011, in Aula Magna José Vasconcelos, main academic venue of CENART. According to this approach, transdisciplinary artworks show, all at once, the six features listed below:

- **Relational**: Transdisciplinary artwork integrates different artistic languages and connects them by solid relationships built at technical, formal and conceptual levels.
- **Performative**: Transdisciplinary artwork emerges, to a great extent, as a result of a live-performance layer, which is activated by the author, a player and/or the public. This feature encompasses, in a wider definition, any form of interactivity.
- **Collaborative**: Transdisciplinary artwork can only be produced by a team which brings together different professional skills, makes decisions under horizontal coordination and shares production responsibilities and credits.
- **ICT-based**: Transdisciplinary artists persistently develop new, original schemes to make use of, and to simultaneously think about, information and communication technologies, such as informatics, telecommunications and digital media.
- **Social**: As a result of the previous feature and a special concern for public space research, transdisciplinary artwork encourages social integration between creators and public (participants) and triggers social activity in the form of games, community-driven dynamics and politics.
- **Complex**: Transdisciplinary artwork unveils hybrid formats for art production which are original, even unexpected, and very difficult to classify according to traditional art taxonomies. Therefore, transdisciplinary artworks are more able to address the complexity of contemporary world than artworks based on traditional languages and formats.

In order to illustrate this approach, readers are advised to review an internationally renowned artwork which clearly shows all of these six features: Rider Spoke, by The Blast Theory, an acclaimed art project from the United Kingdom. Rider Spoke integrates elements from bicycle riding, dramaturgy, performance, game theory, urban communication networks and digital media; and consolidates them as a experience, at the same time shared and private, of wandering a city on the night hours.

As a matter of fact, this approach to transdisciplinarity was built by the author as a result of a long-term analysis on dozens of artworks discussed on Tránsitos operation. All of these artworks are
internationally renowned and were, in most cases, produced by important collective artistic projects. They could be understood as a significant catalog that describes contemporary art production accomplished by trespassing borders between artistic disciplines. The author applied an inductive method on this catalog in order to obtain the six features presented, then established them as an identification pattern for transdisciplinary artwork. He also ventures this approach will be consolidated in near future, or superseded by a more effective version. Meanwhile this personal approach will be used to start up several action items on the intersection between visual music and transdisciplinarity. As long as visual music and transdisciplinarity are both contemporary, fertile and hazy concepts, this operation is expected to bring up an interesting and complex research line.

As a final thought, the author acknowledges a productive extension to this approach, which is based on considering transdisciplinarity not as a collection of features that could be integrated to artworks, but as an essential attribute of contemporary art. This extension is based on the idea that there is no transdisciplinary art, the same way there is no digital art, nevertheless transdisciplinarity and digital are mandatory categories to shape up a definition for contemporary art production. This also encourages a permanent discussion on the role that technology, among other cultural factors, have played as an essential condition for contemporary art.

Visual music

In this section three approaches to visual music concept are discussed: first one is built on musical grounds, second one recognizes that sound form and visual form establish a two-way relationship between themselves, and third one is based on a multiple-level discourse.

Musical approach

McDonnell (2007, p.1) declares:

A visual music piece uses a visual art medium in a way that is more analogous to that of music composition or performance. Visual elements (via craft, artistic intention, mechanical means or software) are composed and presented with aesthetic strategies and procedures similar to those employed in the composing or performance of music.

From this point of view, visual music is described as music made –composed and played– for the eyes: materials have a visual nature but the strategies and procedures used to shape them belong to music art. McDonnell uses this criterion not only to define visual music but also to portray its history. Therefore, visual music roots are shown as a result of orchestration procedures on visual materials like form, movement and time; or as a result of composition and playing operations applied to visual form elements like color.

A tight alignment to musical criteria makes McDonnell's approach a consistent one, but also
narrows its research field in order to adjust it to music theory elements. The productivity of a visual music concept defined exclusively on musical terms might be questioned on the grounds that it excludes significant audiovisual enterprises that cannot be properly described by the resultant taxonomy (experimental urban cinema in the 1920's and 1930's for instance). However, it is essential to acknowledge that McDonnell's approach helps to uncover and appreciate a rich visual arts tradition the establishment, anchored on strategies like figurative form, narrative progression and conceptual displacement, usually minimizes.

Audiovisual approach

According to international symposium Understanding Visual Music 2011 editors:

The term visual music is a loose term that describes a wide arrange of creative approaches to working with sound and image. It may refer to visualized music in which the visual aspect follows the sound’s amplitude, spectrum, pitch or rhythm, often in the form of light shows or computer animation, while in other instances it may refer to image sonification in which the audio is drawn from the image in some fashion. Sometimes visual music describes a non-hierarchichal correlation between sound and image, in which both are generated from the same algorithmic process, while in other instances, they are layered without hierarchy or correlation altogether. Both sound and image may be presented live, fixed of a part of an interactive multimedia installation.

This approach takes the visual music concept far beyond the idea of visual production based on musical strategies. It points out a two-way behavior as a key feature of correlations drawn between audio and video when used as creative materials. From this perspective visual music is not only visual material organized by musical form, but also sound material which is structured in accordance to visual form techniques. This approach also addresses different relation and hierarchy types that can be found on simultaneous use of audio and video, especially when digital technology is involved.

Moreover, UVM 2011's concept of visual music features a productive amount of ambiguity due to the acceptance of diverse valid formats: fixed, real-time or interactive. Henceforth it recognizes complexity as an attribute for contemporary artworks and, this is a considerable improvement, opens a door to artworks that do not come from music or visual arts.

Multiple-level approach

According to See This Sound project (STS) artistic and scientific directors:

The project STS... deals with the present and history of the connection between image and sound in art, media and perception. The starting point is the fact that our world of experience today is characterized by the omnipresence of audiovisual products and structures in which the cultural image and sound production of media technology, art and market is fold intimately. STS responds to that by presenting and discussing different realizations of contemporary art and art history. The current fields of reference range from pop culture to the theory of perception and media technology.
Even though this approach does not make an explicit reference to visual music, it is clear its research domain extensively overlaps the other two approaches to visual music domains. For instance, STS' historic classification includes themes such as experimental animation, painting & music, color organs, graphic notation, music video and sonification. On the other hand, sistematic classification includes topics like audiovisual perception, color-sound-analogies, parameter mapping, synchronization and synesthesia. Therefore, STS project expands visual music concept by means of a multiple-level perspective, able to comprehend many different instances of the sound-form-to-visual-form relationship, activated to a great extent by artistic use of digital technology, but not necessarily located inside music or visual art scopes.

STS project produces a research domain that is simultaneously artistic and scientific, a domain that encompass earlier concepts of visual music, but expands far beyond them by including an ample set of performance scopes, historic backgrounds, creative perspectives and parallel studies. Five years after STS project was launched, its contents might need to be updated in order to consider topics like vj-ing, live cinema, live coding, architectural mapping or body mapping, which are absent on its original taxonomy; however the postulate that activates STS project is, in fact, wider enough to include all these topics as well as other similar not developed yet.

It is precisely this highly-inclusive feature of STS project what encourages thinking about contemporary symbolic production, in accordance to transdisciplinarity research, as a problem that is located in-between, across and beyond single-discipline scopes. From this point of view, earlier concepts of visual music reveal themselves as particular discourses on contemporary audiovisual production that have been elaborated from single-discipline perspectives.

**Visual music and transdisciplinarity**

After a brief review of several approaches to visual music and transdisciplinarity, two topics for further discussion arise on their intersection: the first one deals with the local and historic nature observed in visual music concept when reviewed from a transdisciplinary perspective; the second one attempts to set up a few guidelines for visual music specialists interested in working on transdisciplinarity.

**Local and historic nature of visual music**

When observed from a transdisciplinary perspective, visual music concept reveals its local nature, as a concept that has been built, both at research and at production level, in accordance to guidelines derived from music theory. In other words, it is an artistic topic mostly developed by music art professionals, not only as a diverse corpus of artworks, but also, and perhaps mainly, as a discourse
that comprises the ways their conceptual devices deal with the rich intersection of sound form and visual form. As a matter of fact, this generous and complex corpus of artworks that music art community calls visual music is elaborated and designated under different names by communities from other artistic and scientific disciplines (for instance, experimental animation, sonification, live cinema, etc.).

Regarding its historic nature, it is clear that visual music concept was built on the ground of an opposition that was for a long time crystal clear, but it is not anymore: the opposition between the concepts of music and image. Image is a concept attached to categories such as representation, resemblance and appearance, and was given a visual nature because visual is the nature of mechanical formats that were able to effectively preserve and replicate a representation experience. In a corresponding way, music concept, attached to a refined element combination ability and its temporal structuring, has been elaborated in terms of a sound nature because, for centuries, sound has been the nature of mechanical formats able to effectively deal with the problem of real time.

A detailed archaeology on the image-music opposition, not intended on this paper, should inquire how valid this opposition remains nowadays, when technical devices able to bring together sound and visual production, publication and consume, to erase the border between fixed and real time, and to imagine and author a great diversity of visual musics and sound images are common place. However, from a transdisciplinary perspective, current trends in art production show it is not the time to argue about sound music versus visual music and their specific features, but to organize a solid discourse on the nature and scope of a wider music concept, regardless this music is made out of sound, color, body movement, architectural lighting, or all of them together. In other words, and this is a fundamental key for transdisciplinarity research, a transversal combination-structure-time nature is more important to music than a vertically oriented material called sound.

Visual music and transdisciplinary production

It is possible to understand visual music as an interdisciplinarity instance that happens when artistic disciplines associated to visual production, like painting, cinema, graphic design or animation, work on their materials in accordance to artistic strategies derived from music composition or interpretation. An important factor for this result is what Tránsitos coordinators call the interdisciplinary displacement which, in this case, arises when music art professionals use creative processes and strategies they acquired from music instruction and apply them to create artworks based on formats commonly associated to other disciplines. In an interview with Paul Steenhuisen, Piché (nd) talks about the ability of music composers to deal with time, and how it get him closer to video
Composers deal with time, like video artists and filmmakers. In this new form we’re also talking about design, which can be very intuitive, as long as you have the techniques to put them together, and through electroacoustic music, I have that. I work with some visual artists, and many are completely confounded by the issue of time. They’re not used to it. When design becomes movement, it’s a very different set of skills that apply.

It is worth to remember that sound art frequently shows a significant interdisciplinary displacement that goes inversely: visual artists whose ability to make use of material plasticity allows them to effectively accomplish original timbre production. They might not know how to creatively structure that timbre over time, but they do know how to build it in accordance to what they usually do to materials such as charcoal, crayon or oil.

From these two examples of the interdisciplinary displacement it can be derived that digital audiovisual form reveals itself as a fertile common ground: a shared space suitable to experiment with materials that usually belong to others. This situation reinforces Gibson's approach to transdisciplinarity as a category for digital artwork. However, it is very important to realize that, when it comes to artistic results, there is a big difference between interdisciplinary displacement and transdisciplinarity. The former frequently means a one-man team, a lone artist who accepts the challenge of practicing his own creative arsenal on a language he did not inherit from his discipline. The latter, on the contrary, can only be achieved by a solid team of specialists working in a collaborative way, sharing their particular expertise through engagement and dialogue, in order to build something that is much bigger than the sum of its parts.

Contemporary audiovisual production in art, education, social and even commercial scopes, demands collaborative, horizontal, digital-oriented, transdisciplinary teams, and music or visual music professionals are indispensable to them in order to properly implement high-profile and complex projects. On this ground visual music can be understood as a bridge concept: an experimental, rich, uncertain, and perhaps temporary, zone where music art professionals are granted an interesting opportunity to start a dialogue with experts in other languages, to develop new abilities based on this dialogue and to make significant contributions to the complex and multi-linguistic transdisciplinarity environment. Among these vital contributions the following can be mentioned:

- A considerable mastery of sound materials based on a deep understanding of its formal qualities.
- A powerful sensibility for the development of fine structural forms, especially over the time continuum.
• The ability for instrumental action which instantly activates and balances complex body
dynamics and an intellectual listening.
• A rich set of knowledge and skills required to accomplish original improvisation processes.
• The ability to perform in groups or ensembles, as a collaborative process where creative
decisions and performance responsibilities are continuously shared and shifted.

As a reward, music art professionals involved in transdisciplinary processes will gain benefit
from contributions from experts in different languages and become part of the complex environment
which defines contemporary artwork production.

Conclusion

When observed from a transdisciplinary perspective, visual music reveals itself as a local
concept, built by a music art professionals community on the grounds of key elements of music
theory; and as a historic concept, strongly based on the debatable opposition between sound/music
and visual/image. It is also a concept whose corpus of artworks extensively overlaps those built, under
different names, by other art professionals communities. Transdisciplinarity research suggests music
is more related to a combination-structure-time nature than to the use of a particular material like
sound. Therefore, visual music could be examined as an uncertain, perhaps temporary, concept that
might disappear in a future, as well as equivalent concepts elaborated by other single-discipline
approaches, in order to collectively shape up a contemporary transdisciplinarity environment. Future
assignments for music art professionals under such a scenario seem to be challenging and rewarding.

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Abstract
Focusing on Expanded Cinema practices and theory, this paper examines the relationship between psychedelic lightshows and contemporary VJ practice whilst exploring analogies between expanded cinema’s technologically utopic visions and current Globalization theory. The case study of Digital Cumbia is used to illustrate these ideas and looks at the role of the VJ in disseminating a new visual identity for Latin America through its participation in multimedia immersive performances.

Keywords
Expanded Cinema, psychedelic lightshows, VJ culture, Latin America

Introduction
‘Expanded Cinema’ is an audio-visual practice that overlapped conceptually with Visual Music during the late 1960s and early 1970s. This paper gives firstly a condensed overview of the characteristics that describe this type of work. It then focuses on the artistic intent inherent in North American expanded cinema of the time to explore the relationship between psychedelic lightshows and contemporary VJ culture. Once described by journalist Jonas Mekas as the bringing forth of the ‘spiritualization of the image’, expanded cinema is also imbued with an anti-establishment, technological utopianism evident in the work of artist Stan Vanderbeek and media specialist Gene Youngblood, whose writings describe the media networks as ‘the nervous system of humanity’ and whose practices focus on the creation of a visual language system for a shared global consciousness. Finally I will explore the relevance of these ideas in relation to present-day Globalization, digital media and the role of the Internet in the creation of culturally hybrid audio-visual art forms around the world.

What is Expanded Cinema
Expanded cinema is a term used to describe a wide variety of film-based events, performances and installations that took place in the 1960s and 1970s in Europe and North America but that, according to A.L Rees, is “notoriously difficult” (Rees, 2011, p.12) to define being a “loosely knit set of practices [rather] than a coherent movement”(White, 2011, p.24). The term was “coined by artist Stan Vanderbeek in 1965” (Bartlett, 2011, p.50), and it described then art works that expanded the peripheries of film from a Hollywood-led, single-screen projection in a movie theatre,
to pieces that used multiple projections, non-linear narratives or abstract content and audience activation through performative elements.

Whilst these remained central characteristics of expanded cinema works, as the years progressed two different aesthetic ideologies emerged and developed almost as opposing dichotomies. North American expanded cinema is described by arts journalist Jonas Mekas in 1964 as the “spiritualization of the image” which represented the “primacy of the dream as an analogy for film”, a wrapping of audiences within a shared experience where dissolution of the senses is triggered by “hypnogogic imagery” (Mekas, 1964, p.144). Artist Carolee Schneeman describes the scene in New York in the early 1960s as a “mobile, live and ‘kinetic’ engagement with the cinematic image” (Schneeman, 2011, p.91-97) where theatre pieces such as her work Snows from 1967, psychedelic light shows by Joshua Lightshow, Fluxus concerts of La Monte Young and performances by Yoko Ono and Nam June Paik, all could be described as expanded cinema (White, 2011, p.24). Work coming from the US explored new forms of subjectivity in art through expressionist actions that challenged art media of the time (Rees, 2011, p.13).

In the UK and Europe, expanded cinema developed throughout the early 1970s and centered around the London Filmmakers Co-operative (LFMC), focusing on ‘structural materialist’ film work. In this interpretation of expanded cinema the projectors, process and material, were “primary signifiers in their own right as well as channels for images” (Rees, 2011, p.14). Therefore the elements inherent in the filmmaking process, as well as in its projection, became the work. These could include the projector itself, the sound of the projector as well as the film’s soundtrack, the light beam and the dust that fell through it. Structuralist artists were interested in “provoking differences in perception rather than new totalities or fusions” (Rees, 2011, p.14).

In spite of the different approaches toward the form, North American and European artists were united in their embracing of the inherent liveness of the work. Annabel Nicolson describes this defining trait as “initiating the drama in the film process” (Nicolson, 1972, p.23). For expanded cinema is not just about using multiple-screens but instead, it is about work that is “made in and through its projection”, in other words, film that is not predetermined, ready-made or that can be “recognized independently from its projected instantiation” (Rees, 2011, p14).

In a similar way, artists on both sides of the Atlantic were united by their confrontational distaste towards commercial cinema, which practitioners such as Valie Export and Stan Vanderbeek, saw as representing the oppressive limits set by the state. For Export, expanded cinema was a way of interacting with the filmmaking process through which the commercial, conventional sequence of
filmmaking was broken up by using intermedia techniques such as the “destruction and abstraction” of the material used (Export, 2011, p.290). Through her work she sought not only to destroy the limits of state reality but “to do away with reality and with the language that construes it”, since for her expanded cinema meant also ‘expanded reality’ (Export, 2011, p.293).

These intentions are echoed in the work of Stan Vanderbeek, one of expanded cinema’s most influential artists who, as a fellow at the Centre for Advanced Visual Studies at MIT, was greatly influenced by computer scientist and colleague JCR Licklider and his concept of Co-operative Modeling (an operational social network that can be contributed to and experimented with by all). Vanderbeek saw the cinematic machine as a “distributed system producing normalizing values” on a mass scale, “dominating the senses with only a small range of possible messages and experiences” (Bartlett, 2011, p.58).

Vanderbeek’s Culture Intercom project from 1966 is a proposed expanded cinema work on a mass scale where it is the audiovisual networks of the world that are expanded to perform as educational tools for everyone. Planetariums would act as Movie-Dromes, image libraries, or newsreels of dreams, showing the condensed history of humanity in hour-long performances using thousands of moving, still and sound images. These would be the sites of cultural change, where humanity would be able to “counter the dangerous unpredictability of human action on itself and the world” (Bartlett, 2011, p.54) by understanding its own nature. These sites would be expanded cinemas where audio-visual technologies are redesigned and invented, collaboratively, for social ends and inter-communication (Vanderbeek, 2011, p.80).

This anti-establishment, technological utopianism inherent in Vanderbeek’s practice forms the running argument in journalist Gene Youngblood’s seminal book Expanded Cinema from 1970. Greatly influenced by the North American psychedelic scene during the 1960s, Youngblood’s vision is not only utopic but also futuristic. For him expanded cinema is “expanded consciousness”, humanity’s “ongoing drive to manifest its consciousness outside of its mind, in front of its eyes” (Youngblood, 1970, p.41). He states that the television and cinema networks are functioning as the nervous system of mankind but that the quality of the messages sent out through this system are in contrast to the needs of society: the messages have become irrelevant. The potential for this network to fulfill humanity’s potential is being shunted.

Youngblood however, sees technology as an inherently decentralizing force that forecasts the end of official communication structures, leading him to suggest a new ‘major paradigm’ of cinematic language that he calls the synaesthtic mode: a language through which all senses merge
into each other, where natural chaos becomes the only structure to follow. He suggests that this language has already been achieved through the fusion of aesthetic sensibilities and technological innovation, found in the work of artists such as Stan Brakhage, the Whitney brothers, Nam June Paik and Jordan Belson, amongst others. He adds that in the future “cinema will be one with the life of the mind, and humanity's communications will become increasingly metaphysical” (Youngblood, 1970, p.42).

As can be seen, the term expanded cinema covers a wide variety of practices that at first glance may seem disparate and chaotic, but the following traits describe effectively: the fusion of art forms into multimedia and live-action events, the creation of film work in and through the experience of performing it, a dissolution of the senses triggered by hypnogogic imagery, the breakdown of barriers between artist and audience through new kinds of participation, the exploration of electronic technologies and the coming of cyberspace, and finally the potential for the work to become a social educational/communication tool on a mass scale.

These characteristics coincide at times with principles behind Visual Music practice (communicating musical ideas through visual media), particularly if we consider the environments created through the lightshows in the 1960s, where both artists and musicians sought to induce in audiences a sense of shared consciousness through representations of communal LSD experiences.

**From psychedelic lightshows to VJ culture**

Next, I will be focusing on some of the strands within Expanded Cinema practices that overlap with Visual Music. Primarily I shall be looking at contemporary VJ practices derived from psychedelic light show culture and how this links to globalization theories in view of the technologically utopic narratives within expanded cinema.

Historian Charles Perry writes that light shows as we know them now were first developed in 1952 at the San Francisco State College, where art professor Seymour Locks began experimenting with overhead projectors and paints, swirling and manipulating the liquid in a glass dish. Elias Romero, the ‘grandfather’ of lightshows and author of the 1968 liquid film *Stepping Stones*, was one of Lock’s students. He took the overhead projector and swirling paint ideas and introduced them into the psychedelic scene at Haight-Ashbury in San Francisco (Perry, 1984, p.37). Other artists like Tony Martin or Peter Mays began performing lightshows too and soon the trend spread as far as New York and beyond.

It was Andy Warhol’s performances with the Velvet underground, the first taking place on February 8th 1966 in New York, which instigated a different kind of aesthetic. Under the name
Exploding Plastic Inevitable, Warhol’s multimedia project was the first to tour the USA with live music and a psychedelic lightshow, though his version had a harder edge, incorporating strobe lights, Warhol’s own films and live sadomasochistic rituals (Oppenheimer, 2009). Mary Woronov, who danced for the Velvet Underground during this period, writes that a dichotomy developed between West and East coast countercultures. Whilst in the West “they took acid and were going towards enlightenment; we [in the East] took amphetamines and were going towards death. They wore colours, we wore black; they were barefoot, we wore boots. All they ever said was “wow” and we talked too much” (Woronov, 2005).

Regardless of these differences, lightshows worked because the artists that created them were able to respond to the music in real time by feeling the energy of the people dancing in the room. They could connect to the “group consciousness of their audience” and improvise visuals, layering both abstract and representational images in a constantly shifting collage (Oppenheimer, 2009). It is precisely because of this ‘instantiation’, where the work is created through its performance as a response to the live music, as well as the psychotropic and spatial community elements, that lightshows represent the exemplary meeting point between Visual Music and Expanded Cinema practices.

Furthermore, for Chrissie Iles, Whitney Museum curator, light shows are grounded in the psychedelic experience of synaesthesia, which she describes as the perception of “becoming at one both with others, with the sounds experienced, and with the surrounding architectural space” (Iles, 2005, p.70). Lightshows formed part of a counterculture of the time that aimed to connect people and help raise individual and collective consciousness: a total bombardment of the senses that through hallucinogenic drugs, loud music and swirling light, allowed audiences to alter their consciousness and relate to new ways of seeing the world in contrast to what was communicated through mainstream media.

Media specialist Robin Oppenheimer believes that “some of the original countercultural intentions are visible within contemporary VJ culture” (Oppenheimer, 2009), a notion that I shall explore next, but first I will give a brief overview of the practice.

According to Annet Bekker, the term VJ (video jockey) was first used by staff at the Peppermint Lounge club in New York in the late 1970s but was made popular by cable channel MTV where it was used to describe the video presenters (Dekker, 2005). Bekker states that it was the availability of cheaper video cameras and the introduction of projectors in the 1980s that made it possible for VJ performance to assume its present form. Xarene Eskandar, co-author of ‘vE−jA, a
snapshot of VJ culture in 2006, describes it as an art form that grew out from the electronic music scene, “a technology oriented, live, spontaneous and interactive art” (Eskandar, 2006, p.4). Many of the artists she interviewed emphasize the importance of live performance as an intrinsic element in VJing. Live settings demand from VJs high degrees of spontaneity and improvisation as they often make interpretations of unknown music, with unknown crowds and environments, on the go.

Eskandar considers the introduction of visuals to the electronic dance scene as the element that completes Kandinsky’s vision of the dance-art of the future. In this vision, musical, pictoral and physical movements combined, make up the spiritual movement, “the working of the inner harmony” (Kandinsky, 1977). Eskandar likens this spiritual harmony to that attained by the thousands who have attended raves around the world, collectively transcending “amidst the music scene and the atmosphere with the DJ as spiritual medium” (Eskandar, 2006, p.5).

This analogy echoes Youngblood’s visions of an expanded consciousness through the ‘synesthetic language’ also envisioned by Vanderbeek in relation to his ‘Culture Intercom’. That age-old “drive to represent consciousness outside of the self” (Youngblood, 1970, p.41) continues to be manifested through the work of VJ artists using abstract imagery and multiple visual sources. The thirst for experiencing synaesthesia occurring less as a result of drug induced hallucinations but instead, as Berlin-based VJ Marius Watz argues, a response to our multimedia-saturated world, “a reflection of the post-digital human condition where we routinely multitask and navigate data flows through software interfaces existing in several places at once through the use of personal communication technologies” (Watz, 2006, p.6).

However, Bekker recalls that not all VJ artists have maintained a counterculture attitude in their work. Specializing in Netherlands’ VJ culture in the mid-1990s, she noticed that the new generation of club-based artists was without politics. They simply wanted to create beautiful images for feel-good results and entertainment. In contrast to the previous generations, all notions about ‘opening up perceptions’ were merely “vague ideas” (Bekker, 2005, p.3). Still, not everybody agreed with these statements, artists such as Lucas van der Velden (Telco Systems) wanted to “shake people awake” but “without any obvious finger-pointing” or literal messages about what should be done (Velden, 2005, p.3). The main problem here is that with electronic music’s increased popularity since the 1990s, the commercialisation of the scene has been inevitable, which shunts those voices that are deemed too serious or accused of thinking too much. Sue Costabile, who VJs under the name SueC, remarks that the American VJ scene “bridges the gap” (Costabile, 2006, p.60) between purely artistic
projects and the entertainment industry, mainly out of necessity, for those who are involved in visuals also need to make a living.

So whilst contemporary VJ culture shares some of the characteristics of expanded cinema in their use of digital technologies, multimedia, abstract imagery and live performance techniques, depending on the degree to which the scene has been commercialized, the idealistic, visionary and utopic intent, reminiscent of Youngblood and Vanderbeek, flickers. However, the art form is still young and as the Internet reaches further out into all the corners of the Earth, new technologies reach the hands of new generations of artists, who combine these tools with local sensibilities, creating cultural scenes, were the synesthesia mode finds fertile ground.

**Technological utopia in practice**

In *Landscaping the Global Imagination* (Perezzarate, 2014), I describe two case studies in which new Latin-American electronic music scenes, Nor-Tec from Mexico and Funky Carioca from Brazil, behave in a cannibalistic manner. Artists from these scenes gobble up cultural influences and material, as well as technology made available to them through the World Wide Web. Through this ingestion, they create hybrid works imbued with a local flavor and social relevance. These scenes are at the root of a decentralization of cultural power from the northern hemisphere towards diverse localized centres. In these case studies, London and New York are still influential, but so have become places such as Tijuana and Rio de Janeiro. Thanks to these scenes, local economies are improving, even though in the global market, most of the money still trickles north.

Appadurai’s concept of the *scapes*, show how imaginary landscapes are created in the minds of individuals through the global culture we consume, the places we visit, the money we transfer and the technology that gets downloaded, these new sites have the potential of subverting nationalist narratives in favour of shared, albeit imagined, cultures functioning locally but disseminated through global networks worldwide. The aforementioned case studies support this idea, since they show that these scenes’ success at a global level is inextricably inked to the Internet, where people from all corners of the earth can gain access to this music, thus finding points of relation with people from localities on the other side of the world.

In view of my studies into expanded cinema, I can now make analogies linking Appadurai’s *scapes* and Youngblood’s ‘expanded consciousness’ vision. The imaginary landscapes where people from Japan may find common ground with musicians in Buenos Aires as a result of their shared musical affinities manifested through online tools such as Facebook, Youtube or Soundcloud, make Youngblood’s heralding of the coming of “metaphysical communication” a reality.
Similarly by holding on to that same thread of technological utopianism, Vanderbeek’s “culture intercom”, looks comparable to the way the Internet can work as it has clearly become ‘the nervous system of humanity’. We might not have access to local ”Movie-dromes” but our personal computers with fast broadband connections provide individuals control over a multimedia experience that has become ubiquitous, where almost all the information required to understand humanity is at our disposal, through text, video, animation, sound and interactivity. This global networked consciousness, far from theoretical, enables real positive changes to occur at a local level.

A further example I would like to briefly explore is the case study of the visual language surrounding the increasingly popular Digital Cumbia (DC) scene that has taken Latin America by storm over the past decade. DC has enabled the Latin American community at home and abroad to view itself through a futuristic lense that has been denied to that part of the world by the Hollywood-centred mass media.

Digital Cumbia (also known as Nueva Cumbia or Electro Cumbia) merges together local folk influences from traditional cumbia and combines them with production and compositional techniques from European and North American electronic music. DC has spread throughout Latin America with ease because traditional cumbia was already popular across the continent through its various incarnations, including the big bands of the 1920s-1950s, the Cumbia Amazonica wave of the 1960s and 1970s and the urban cumbia from the 1980s. However, by the late 1990s cumbia was considered an unsophisticated musical form and shunned by the middle classes across the continent. DC, through its use of technology and fashionable visual language turned an outdated genre into the hip movement of a growing middle-class. The record label that has been most influential in achieving this is the Buenos Aires-based ZZK Records.

From their first releases, their album covers brought forth a vision of Latin America that was technologically driven by a futuristic digital aesthetic: pixelated llamas posed in front of a darkened Andean landscape for King Coya’s Cumbia de Villadonde, a robotic female coyly shooting laser beams from her left nipple posed in front of astral pyramids for Frikstailers’ Guacha, whilst an Andino boy’s face glowed by the aura emanating from his drum whilst he floated through the cosmos on Chancha Via Circuito’s Semillas EP.

The growing VJ scene surrounding DC has also been influential in disseminating this new Latin American visual identity through the parties and gigs that take place on a weekly basis across the continent. Influential and globally renowned acts such as Chancha Via Circuito, Dengue Dengue Dengue, El Remolol and La Yegros, perform regularly with artists such as VJ Sixta from Peru,
Ailaviu from Argentina, Maria Jaramillo from Colombia or Chindogu from Uruguay. All of whom have been involved in multimedia immersive performances across the continent displaying animated versions of the themes found within ZZK album covers and videos, such as the recent *Trifasico* event at Bulbo in Peru on March 2015, or the *CACICAZGO* live installation by Fidel Eljuri for Urban Beats in Ecuador on February 2015.

At the time of writing I am carrying out interviews with the previously mentioned artists to learn more about the nature, intent and reach from the new Latin American school of technology-driven, spontaneous and most importantly, live, Visual Music. It is still to be seen whether expanded cinema’s utopic, anti-establishment torch has been passed across continents through a digitally expanded consciousness or whether it has succumbed to the pulls and shoves of the entertainment industry.

**Conclusion**

Expanded Cinema describes a wide range of works that fulfill some or all of the following characteristics: a fusion of art forms into multimedia and live-action events, it’s visual language is an analogy of dreams, causing the dissolution of all senses through hypnogogic imagery, the content of the work is created in and through the experience of performing the work, it breaks barriers between artist and audience through new kinds of participation, it explores electronic technologies and the coming of cyberspace and it has the potential to become a social educational tool on a mass scale.

These trends can be seen in the immersive environments created by 1960s lightshows seeking to communicate the psychedelic aspects of the live music it responded to. In this sense, Lightshows represent the perfect overlap between Expanded Cinema and Visual Music practices. The precedent set by psychedelic culture enabled VJs to continue experimenting with the performance of live visuals as electronic music became increasingly popular. Whilst some contemporary VJs shy away from imbedding political statements in their work, other artists see and act upon the consciousness-raising potential in their practice.

This potential is the same that inspired the work and words of Vanderbeek and Youngblood. Through examining their visionary thinking it is possible to make analogies with Globalization theories to understand and wonder at the way our world works as it becomes increasingly more connected. A new school of Latin American audiovisual artists, with all the technological tools required at their disposal through the web, are experimenting and beginning to lead in the creation of

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immersive environments, reminiscent of the 1960s lightshows, expanding group consciousness at local events, disseminated through global networks.

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GIVING VISUAL FORM TO ‘ABÎME DES OISEAUX’: GIVING VISUAL FORM TO ‘ABYSS OF THE BIRDS’

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Abstract

Abîme des oiseaux was composed in extraordinary circumstances by Olivier Messiaen in 1940-41. The piece, for solo clarinet, embraces birdsong and extreme contrasts in tempi. I’ve performed it myself in London and I can well understand the mesmerising impact it would have made in a frozen Silesian prison camp over 70 years ago. In creating the visuals for Abîme des oiseaux I have been guided by two key facts. First, Messiaen’s ability to see music in vivid colours and, secondly, the inspiration he derived, as a lifelong Catholic, from the shimmering stained glass windows of Chartres Cathedral. Details from just one window have enabled me to interpret, visually, the extreme contrasts in mood conveyed by Messiaen’s music.

Keywords

Messiaen, Clarinet, Birdsong, Sound-colour, Chartres Cathedral

Introduction

By combining computational design and clarinet playing, I have developed a presentation technique which enables my visual and aural interpretations of pieces of music to become the basis of Performances. By calling on my skills as a clarinettist, my renderings of selected compositions for solo clarinet are matched by the simultaneous projection of my visual interpretations of the pieces. The result is Visual Music. For this UVM Symposium I am going to share with you my aims and method in giving visual form to Abîme des oiseaux (Abyss of the Birds) – the third movement of Olivier Messiaen’s Quatuor pour la fin du Temps (Quartet for the End of Time).

Derivation of Abîme des oiseaux

Composed in extraordinary circumstances, in 1940-41, Abîme des oiseaux was the first of the Quatuor’s eight movements to be written. Messiaen and two musician colleagues, Etienne Pasquier and Henri Akoka, were all members of a French military orchestra installed in Verdun. They became fast friends and it was at this early time in the Second World War that Akoka prodded Messiaen into writing a piece for solo clarinet. No doubt the piece was influenced by the friends’ daily ritual of listening to the chorus of waking birds; the composer had long regarded the clarinet as
the ideal instrument for imitating birdsong which explains why the he chose this subject for his *Abîme des oiseaux*.

Before Akoka had a chance to play the piece, all three of them were captured in a forest by the Germans and forced to march forty three long miles to the vicinity of Nancy. It was here, in an open field, that *Abîme des oiseaux* was first played. Akoka, who, remarkably, had kept hold of his clarinet, read through the piece, Messiaen listened and Pasquier acted as the music stand. It was only later, after all three of them had been sent to Stalag VIIIA in Silesia, that the composer was able to incorporate *Abîme des oiseaux* into his much longer *Quatuor pour la fin du Temps*.

**Messiaen’s self belief**

Messiaen’s attitude to prison life differed from that of many of his compatriots. He stated afterwards that he had “never felt so free” – a paradox that can be explained only by the composer’s determination to continue composing, come what may, even in the most inhospitable and alien of surroundings. But he received help from an unexpected quarter. The German commandant of the camp, and some of his officers, were music lovers; Messiaen’s reputation as an up and coming composer had preceded him which meant that he received special treatment – no extra rations, which were minimal, but permission to retire to the latrines where conditions for concentrated composing were slightly better than anywhere else at Stalag VIIIA. Messiaen was already able to remove himself from his surroundings at a psychological level but, no doubt, it helped him considerably to be able, also, to detach himself physically. In spite of temperatures of 25° degrees below (Celsius), he considered himself lucky. Some of his compatriots resisted and attempted to escape but Messiaen refused such opportunities; he had a considerable degree of self belief and felt that God had placed him in the camp for a reason.

Now back to *Abîme des oiseaux*, which is approximately 8 minutes in length. As I’ve explained, it was written for Henri Akoka who was noted for his considerable personal charm as well as his remarkable ability as a performer; he later came to be called the Kreisler of the clarinet. *Abîme des oiseaux* embraced many of the key features of the completed *Quatuor* – birdsong, a-metrical rhythmic patterns and extreme contrasts in tempi. Akoka complained about the technical demands made by the composer but, with Messiaen’s encouragement, he gradually overcame these difficulties.

**First performance of Abîme des oiseaux**

Messiaen’s instrumentation for the eventual *Quatuor* was dictated by the availability of instruments and performers. Prisoners at the camp contributed towards a cello purchased in Görlitz for Pasquier, Messiaen played on a piano with sticking keys and, somehow, the violinist, Jean Le
Boulaire, like Akoka, had managed to retain his instrument. So that was it; the commandant allowed the group time to practise in the camp theatre (which contrary to all accounts could contain only a few hundred prisoners with their guards). Messiaen has stated, about the first performance, that he had never played previously to an audience so attentive, silent and ‘captivated’ by his newly discovered musical language. Because that’s another important aspect of the *Quatuor for la fin du Temps*; it was the piece where the composer formulated a sound world which stayed with him forever afterwards; it represents a pivotal point in Messiaen’s musical development.

The composition and performance of the *Quatuor* revealed Messiaen’s determination to overcome feelings of despair during his imprisonment at StalagVIII A. Yes, he would have become a great composer without his prison experience but, perversely, the harsh conditions of camp life had succeeded in both concentrating his thoughts and hastening his development as a composer at a crucial time in his creative life.

**My own experience of the Quatuor pour la fin du Temps**

As a clarinettist myself, I have given a few performances of the *Quatuor* at various venues in London. It always has a mesmerising impact on the audience to such an extent that I can well understand the sense of wonder generated in a frozen Silesian prison camp over 70 years ago. In making *Abîme des oiseaux* the subject of this Paper, I have needed to reconcile the fact that Messiaen didn’t approve of separating this third movement of the *Quatuor* from its surrounding movements. My defence, in breaking from the composer’s wishes, is first that it’s been done many times before; many clarinettists play *Abîme des oiseaux* as a separate and extraordinarily effective solo piece. Secondly, Messiaen wrote the movement before he had necessarily conceived either the idea or the instrumentation for the complete *Quatuor*.

**Meeting the challenge**

Creating the visuals for *Abîme des oiseaux* poses a challenge but I have been guided by two key facts. First, Messiaen saw his music in vivid colours; he believed in the concept of sound-colour which enabled him to visualise the ‘colours’ of other composers, particularly Debussy and even Mozart. Secondly, Messiaen always said he was born a believer and he retained his religious conviction, as a Catholic, throughout his life. This helps to explain why, for him, Chartres Cathedral became a place of pilgrimage and, in particular, the shimmering textures of its stained glass windows and use of ‘Chartres blue’ remained a life-long inspiration. It must be remembered that Messiaen revered not only nature and the singing of birds (in his opinion, the world’s greatest musicians) but also the radiance of colour.
Given this knowledge of Messiaen’s sources of inspiration, I have chosen to base my visual imagery for *Abîme des oiseaux* on the windows of Chartres Cathedral. Further, I have found all the components that I need in one particular window – the 13th century Rose Window of the North Transept (see Figure 1). By taking various details from this one window, I can interpret, visually, the extreme contrasts in mood conveyed by the music – both its moments of ecstasy and despair!

**Details of my visual interpretation**

The tempo of *Abîme des oiseaux* at its start (*Lent*) is extremely slow; the metronome mark is quaver = 44. To match its desolate mood, I have conjured up a series of slowly changing textures all derived from details of the Rose Window. The resulting patterns, more often than not, are abstract but sometimes they reveal figures or forms that are recognisable – in particular, birds (Gifts of the Holy Spirit), which appear in a series of textures that resemble glittering mosaics (see Figure 2). These images are derived from the innermost ring of panels that surround the central oculus of the Rose Window.

In the next section of the piece, which is much faster (*Presque Vif*), the bird panels take flight to simulate Messiaen’s cacophony of bird song - an ecstasy of sound that is matched by visuals of birds flocking with abandon high in the sky (see Figure 3). It is at this stage that the viewer is shown, for the first time, a glimpse of the almost complete Rose Window turning slowly as the piece winds down to its initial slow tempo.

*Abîme des oiseaux* is an exercise in contrasts where ecstasy is followed by desolation. So, again, as the piece is drawing to a close, I produce slowly moving textures based again on facets of the Rose Window. This time, the Kings of Judea become recognisable before the piece ends with a final desperate flourish of birds.
Figures

Figure 1: Part of the Rose Window located in the North Transept of Chartres Cathedral. The innermost ring of panels depicts birds (Gifts of the Holy Spirit). The outer ring of square panels depicts the Kings of Judea.

Figure 2: A glittering mosaic of birds (derived from the innermost ring of Rose Window panels)
Conclusion

In giving visual form to *Abîme des oiseaux* I have explored new techniques and methods for producing visual music and, in doing so, I hope I have played a part in advancing the cause of visual music and digital culture generally. In its time, Messiaen’s *Quatuor* was revolutionary; it was pivotal not only in Messiaen’s own musical development but, also, in the overall development of classical music in the 20th century. Particularly in *Abîme des oiseaux*, the composer explored a path of extremes by inventing new a-metrical rhythmic patterns, extending the top register of the clarinet to its limits, demanding both very fast and very slow tempi, and insisting on a range of amplitude which extended from *pppp* to *ffff*. All these aspects of Messiaen’s composition have provided a starting point for producing visuals which, similarly, follow a pattern of extremes. The complete result can be seen at [http://youtu.be/eGsTgQAbvxY](http://youtu.be/eGsTgQAbvxY)

My overall aim is to ensure that an audience’s appreciation of Messiaen’s work is much heightened by my visual/musical interpretation. Inevitably, my interpretation must represent a personal odyssey and I can never know whether or not the composer would have approved but I do know that it was his ambition to translate into his work the myriad of colours mentioned in the Apocalypse – in fact, all the colours of the rainbow. For this reason, is it just possible that he would
have appreciated my efforts in bringing together two important passions of his life – the shimmering colours of Chartres’ windows and a visual representation of singing birds in mid-flight?

References


Abstract
This paper discusses the method of translating pixel data from a digital image or film to a wavetable for sound synthesis. This method is not new, but has recently reached popularity in many audiovisual projects. It is commonly referred to as scanline synthesis. It is an attractive method insofar as the sound is directly derived from the visual information and it therefore immediately renders audible changes in the visuals. In its direct form, scanline synthesis has in most applications quite a characteristic sound, although in principle any pitched timbre can be produced by scanline synthesis. The basic principle is that pixel values from a digital image are copied into an audio buffer which is then used as the waveform for a wavetable oscillator.

Keywords

Introduction

The basic principle of scanline synthesis is based on copying pixel values from a digital image into an audio buffer which is then used as the waveform for a wavetable oscillator. The pixels are usually read along a straight line in the image, but generally speaking an arbitrary grouping of pixels could be translated to a waveform.

The first part of the paper explains the basic principles of scanline synthesis. After laying out the essential aspects some methods are introduced that lead to a higher degree of control regarding the sonic spectrum of the sound. All technical issues of the paper are presented for readers who are not experts of electronic music. A very basic understanding of programming is helpful in order to understand the examples in pseudo code, but not absolutely necessary.

In the last part of the paper practical applications of scanline synthesis will be discussed. An important aspect is its usability in an artistic contest and the degree to which congruence between image and sound can be sensed. Some examples from existing works will be illustrated in order to

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40 See for examples: Ryoho Kobayashi Scanline Computer Music, Christopher Jette Soundlines, Dave Poultner Scanline Granular Synthesis or the author's works Formula minus One and Via
41 not to be confused with scanned synthesis which is also a synthesis technique based on wavetables, however unrelated to audiovisuality.
42 All standard oscillators in digital synthesis are reading usually predefined wavetables. Wavetable oscillators give access to the wavetable so that the user can shape the waveform at will.
show different artistic solutions.

**A quick overview of scanline synthesis**

**Wavetables**

With analog sound generators, oscillations of electric currents are produced by specific circuit designs that generate periodic voltage changes. With digital oscillators these analog oscillations are emulated by so-called wavetables, that can be thought of as lists – usually referred to as arrays – of numbers that describe the shape of a single period of an oscillation with discrete values.

![Figure 1: analog signal: continuous line; digital signal: black squares (discrete values)](image)


By repeatedly reading through these tables many times per second, and eventually converting the digital numbers to an analog signal, a similar oscillating current can be produced. Wavetables in early digital synthesizers contained 256 values or less. Today they are usually multiple times bigger than that.

In simple digital synthesizers these wavetables are usually pre-programmed according to standard waveforms and are not changeable. However, in computer software it is ease to fill wavetables with new values, even while a sound is being produced with the very same wavetable.

Scanline synthesis does just that by taking the numeric values from pixel values of digital images. Hence, an aspect of an image is rendered audible. There is a direct relationship between the pixel values on a screen and the wave-table values, and therefore between the visuals and the sound. Therefore this method has often been used in the context of visual music and audiovisual works in general.

**Pixel Values**

The values of pixels are stored as groups of bytes, which corresponds to a value range from
0-255. Depending on whether an image is colored or grayscale and whether or not the pixels have a value for opacity (alpha channel), a pixel contains between one and four bytes.

In a grayscale image the first channel is the darkness of the pixel, which is mapped between black and white on the range from 0 to 255. Color images have three bytes for the colors red, green and blue respectively. If an alpha channel is present it is added as a second channel with grayscale pixels or as a fourth channel with color pixels.

Converting pixel values for wave-tables

Digital audio signals consist of floating point numbers in the range between -1 and +1. When translating pixel values for wavetables, the larger numbers have to be mapped to the smaller range by dividing the pixel value by 127.5 and subtracting 1 from the result.

Pseudo code:  \[
\text{audioValue} = \frac{\text{pixelValue}}{127.5} - 1;
\]

However, first it has to be decided, which channel of the pixels is used for the conversion, if several channels are available. With color pixels it is common to translate them to gray values – also called the luminance values. The NTSC standard for the conversion of color images to black & white states that the red, green and blue values have to be scaled with different weights.

When translating RGB values to grayscale, the following weights should be used:

\[
\text{red value} \times 0.299 + \text{green value} \times 0.587 + \text{blue value} \times 0.114.^{43}
\]

However, it should be noticed that the conversions from pixel values to wavetable values are perceptually largely arbitrary, hence the accuracy of e.g. converting color to grayscale may not be so significant. Issues concerning the perceptual correlation between the two media are going to be addressed further below.

Offset removal

Let us assume we are using a wavetable with 512 values and we are scanning a dark image. A large number of pixel values might be smaller than half of the 8bit range (a number lower than 128), which will result in values in the wavetable that are below zero. As such, this is not a problem but in digital signal processing it is considered not to be optimal if the average of all values in a wavetable is far from zero. Such deviations of the average value are called digital offsets.

In extreme cases such offsets can endanger the loudspeakers. Hence it is a good precaution

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to check all values that have been extracted from an image for their average value and to shift them in such a way that they average to zero.

If in our example the average (after converting from the 8 bit pixel range to the digital audio range) would be e.g. -0.3, every value in the table should be increased by this value, so the average ends up being zero.

Pseudo code:
```plaintext
waveTable = [0, 0.2, -0.9, -0.5];
average = 0;
for(i = 0; i < waveTable.size; i++){
    average = average + waveTable[i];
}
average = average/ waveTable.size;
for(i = 0; i < waveTable.size; i++){
    waveTable[i] = waveTable[i] + average;
}
```

For clarity the example codes use only short arrays with merely four values. In scanline synthesis a common size would contain 512 or 1024 values.

Palindromic reading of the wavetable

Let's assume that we are applying scanline synthesis horizontally to an image which is dark on the left side and gradually gets brighter towards the right. This would lead to numbers in the wavetable that are low in the beginning and higher towards the end. Since during synthesis a wavetable is read many times a second, there would always be a rather large jump from a high value to a low value, between the last value of the table to the first. This is not problematic, but every bigger sudden change of values in a waveform – in other words: every sharp edge in the signal – adds high partials to the sounds. In some cases this can lead to an undesired sharpness in the sound.

In order to prevent this, the size of the wavetable could be doubled and the numbers that were generated from the image could be placed in the wavetable twice, but the second time in a mirrored fashion.

Pseudo code:
```plaintext
pixelValues = [-0.5, -0.2, 0, 0.9];
waveTable = [0, 0, 0, 0, 0, 0, 0, 0]; // twice the size of the array pixelValues
for(i = 0; i < pixelValues.size; i++){
    waveTable[i] = pixelValues[i];
```
waveTable[waveTable.size - (i + 1)] = pixelValues[i];
}
result: waveTable = [-0.5, -0.2, 0, 0.9, 0.9, 0, -0.2, -0.5];

Effectively this is the same as a so-called palindromic reading of a wavetable. A palindromic reading reads from left to right but instead of jumping from the last value to the first of the wavetable, it reads the numbers from right to left, once it reached the last value of the table.

By using the mirroring above, the same result can be achieved while keeping the reading direction, the disadvantage being that the memory required for the buffer doubles. If the size of the array is supposed to remain the same, the values could be down-sampled (using only every second value) before copying them to the wavetable.

**Adding timbral variability to scanline synthesis**

Interpolating between wavetables

When working with digital color images, practically any color channel can be used in order to extract a value for a waveform, or – as mentioned above – the values can be recalculated in order to generate luminance values (grayscale). An interesting method is to work with multiple wavetables and to seamlessly interpolate between their values. For example, the R, G and B values of an image could be used to generate three wavetables.\(^4^\)By interpolating between the three wavetables, modulations in the timbre can be achieved which add liveliness to the sound that can otherwise easily sound too static.

Interpolation between two tables take place by morphing between the individual sample values of the two tables. Usually a blend value is used for the morphing which is a floating point number between 0 and 1. If the blend value is 0 the values of the first table are used; if the blend value is 1 the samples of the second table are used. If the blend value is 0.5 a value in the middle between the corresponding individual samples is used. In pseudo code interpolations can be expressed as follows:

\[
\begin{align*}
tableA &= [0, -0.2, 0.9, -0.5]; \\
tableB &= [0.5, 0.3, -0.2, -0.4]; \\
blendTable &= [0, 0, 0, 0]; // the result of the interpolation \\
blendValue &= 0.2;
\end{align*}
\]

\(^4^\)The alpha channel is usually not interesting for scanline synthesis, as – if it is present – it is commonly set to the same value for all pixels in a digital image.
for(i = 0; i < blendTable.size; i++){  
    blendTable[i] = tableA[i] + ((tableB[i] - tableA[i]) * blendValue);
};

If blendValue would be 0.2, the result would be: [0.1, -0.1, 0.68, -0.48].

Smoothening or harshening a waveform

Any sound can be encoded in an image, smooth sounds or sharp sounds. However, the principle of scanline synthesis will always generate pitched material, since a wavetable synthesizer keeps reading through a table over and over again. Therefore every waveform – disregarding how erratic it might be – will be played periodically, which results in a clearly recognizable pitch.

When applying scanline synthesis to concrete images, the timbre often tends to be rather harsh. As mentioned above any sudden change in the signal of the waveform emphasizes high frequency components. The data generated from digital images often contain quite a few edges, due to different colors or contrasts in brightness in the image.

If it is desired to tame those high frequency components or to even emphasize them, the data from the image could be transferred to the wavetable in a non-linear fashion via a so-called transfer function. A linear conversion would mean that the proportions between the individual values in the source is identical with the proportions of the corresponding values in the scaled target. Non-linear conversions, however apply functions during the conversion, e.g. exponential functions.

Let us first take a look at two different transfer functions:

Figure 2: green line: linear scaling, red and blue line: different transfer functions
The green line shows the linear values how they are mapped from the 0 to 255 range (x-axis) to the audio range -1 to +1 (y-axis). The red and blue line are showing two different non linear transfer functions that behave like mirror versions of each other.

The blue line is a cubic exponential function. Here, the cubic values have been taken of each number from the pixel range (0-255). The results have then been divided by the square of 255, in order to bring the numbers back to the range 0-255. Then they have been converted to the audio range. It is characteristic of this function that values in the low range are closer to each other when compared to the linear function, while the intervals start to get larger than in the linear function, when they are above a value of ~147.

Let's assume we have data from an image with very large contrasts in the low numeric range and we would like to make the differences between the numbers smaller. Here are our original values:

\[
\text{pixelValues} = [90, 12, 67, 3]; \quad // \text{differences between the values: } -78, +55, -64
\]

If we apply the cubic transfer function, the intervals between the numbers get smaller:

\[
\text{cubicValues} = \left[ \frac{90^3}{255^2}, \frac{12^3}{255^2}, \frac{67^3}{255^2}, \frac{3^3}{255^2} \right] = \left[ 11.21, 0.03, 4.63, 0 \right]; \quad //
\]

approx. differences between values: -11, +4, -4

Smaller waveforms will lead to stronger bass components and less sharpness in the sound. If the opposite is desired, the same method can be used while using numbers smaller than 1 as the exponent. The red line shows such a transfer function in which the exponent is 1/3:

\[
\text{pow}(1/3)Values = [90^{1/3}, 12^{1/3}, 67^{1/3}, 3^{1/3}] / 255^{2/3} = [180.21, 92.06, 163.32, 58]; \quad //
\]

approx. differences between values: -88, +71, -105

In pseudo code, a transfer function for pixel values can be expressed as:

\[
\text{pixelValue}^{\text{exponent}} / 255^{(\text{exponent} - 1)}
\]

Transfer functions can easily increase digital offsets, therefore the above mentioned method for offset removal should be applied. Also the amplitude of the signal can be strongly affected and might have to be adjusted.

**Experience of congruence between the sonic result and the visual information**

As mentioned above, any sound can be stored as an image, therefore it is not really correct to speak about a general character of scanline synthesis. However, with the vast majority of visual material, the resulting sound often has the aforementioned harshness, due to the unevenness of the resulting waveform.

In many contexts this quality might be exactly what is appropriate. However, in some
contexts it might not be sufficiently flexible for more subtle musical expressions. In such cases it is highly recommended to use interpolations or transfer functions in order to introduce malleability into the resulting sound.

With scanline synthesis it is usually not possible to find a direct correspondence between a static image and the sound, except for rare cases, where the image leads to a very characteristic standard waveform sound as in the following example:

Figure 3: Ciciliani, Marko: *Formula minus One* (here, a vertical and a horizontal scanline are used simultaneously. They are displayed in light blue color)

In this case the symmetric composition of the image generates almost correct square waves which are characterized by the absence of even partials and therefore give it a somewhat hollow and clarinet-like quality. In this example the resulting waveforms are displayed as lines in light blue color.

With scanline synthesis the correlation between image and sound is more commonly experienced by the change of the image (when using films), or the change of the position of the scanline in time. In such a case it becomes obvious that changes in the reading position of the visual image are immediately reflected in changes of timbre. This is also the great strength of this method, as any changes in the image lead to fluctuations in the sound, even though the exact effect can not be predicted. This is why some artists decided to display the scanline in the visual part of the work, thereby making the process more transparent.

Ryoho Kobayashi, for example, used static images in his work *Scanline Computer Music*, but the scanlines are slowly moving across the image and thereby rendering audible constantly changing details. The scanlines are displayed as red lines with either horizontal or vertical orientation. In addition, he displays the extracted data as stripes of grayscale values that are placed on the right side of the image for the vertical scanlines, and underneath the image for the horizontal scanlines. Up to 8 scanlines are used simultaneously with every orientation, which leads to an impressive sonic
richness, which is projected through a multispeaker setup.

Figure 4: Kobayashi, Ryoho: *Scanline Computer Music*, here multiple scanlines are used on a static digital image. The values that are extracted are displayed on the right side for the vertical lines and underneath the image for the horizontal lines. Each line generates a separate wavetable.

In the next example, *Soundlines* by Christopher Jette, scanline synthesis is applied in a situation where a dancer directly interacts with the synthesis. This implementation is a different one than what was described above. Here, sound is only heard when the dancer moves. Apparently the algorithm is ignoring any pixels that have not changed recently – a technique also referred to as constant background removal. This points in an interesting direction for further investigation, as in this work, scanline synthesis is not merely used for the generation of a particular characteristic timbre, but it also generates rhythmic structure from the visual input. In contrast to the previous examples, Jette does not use any projection in order to display the resulting waveform.
This example is also interesting because it presents a strong contrast between the organic movements of the dancer and the resulting sound, which has a erratic and stuttering quality with the typical harsh timbre. Here, two different media collide, allowing for attribute transfers to swap back and forth between the two.

Numeric translations between media should always be used with great care, if perceptual congruence is desired. Formal translations can neither guarantee that they are perceived as such, let alone that they are perceived as interesting.

Scanline synthesis is suitable for audiovisual contexts because it guarantees temporal congruence. In artistic contexts, however, semantic and mood-based congruences are at least equally important. Therefore the manner how scanline synthesis is applied has to be reevaluated and creatively adjusted depending on the context.

**Conclusion and future investigations**

The application of scanline synthesis in audiovisual projects is an interesting method to create a direct correspondence between a digital image and the resulting sound. When it is applied in its pure form, the musical variability is somewhat limited, but methods have been presented that are very suitable for adding sonic variability.

Aesthetically, formal translations should always be treated with caution, of perceptual congruence is desired. Scanline synthesis entails temporal congruence but semantic and mood-based congruence still have to be designed according to the artistic context.

How the sound relates to the chosen visual material still leaves a lot of space for experimentation. Future investigations could include the possibility of reversing the direction of data flow. In such a case the shape of a waveform would determine the image and not the other way round.
Yet a further step could consist of combining both directions of data-flow and to investigate scanline based feedback constellations.

References
LIVECODE READINGS - ALGORITHMS VIEWED AS TEXT/IMAGE

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Abstract
As new ways to represent text/image in unison with other arts, LiveCoding sessions have been one of the contemporary options where the union of music, visuals, algorithms and science get together to make a community experience. The live programming performances where the music or visual result is part of a whole experience that join with the programming algorithms to build a new layer of text that can be experienced not just as a process but as a narrative by itself. The Sound result can be perceived not as an audio performance but as the relationship with the algorithms that create not just a series of instructions but a visual and abstract representation of what you heard combining images to create and share a process.

Keywords
LiveCoding, Digital, Visual, Music, Receiver, Image, Text

Introduction
As new ways of constructing narratives through more scientific languages, and as part of bringing back the use of algorithms to build a set of rules to conform a more aesthetic visual/sound result, LiveCoding is part of the contemporary practices in Art, which uses it along all kinds of knowledge to experience aesthetic processes. As told, the use of algorithms is not new in art. During the 50’s, Ben F. Laposky (1953) created a series of pictures called “Electronic Abstractions: Oscillons”, generated through algorithms on an oscilloscope that produced wave shapes. Since then, the use of a specific language, plus the construction of modern computers, allowed other ways to produce culture. LiveCoding is, as Alex McLean (2007, p.16) describes: “writing in a computer program while it runs”. We are now able, not only to show the sound/visual result, but also the code itself, as part of a sharing process. The projection of the code transforms into a complex language to communicate something to the interface, as well as a piece of a visual section that interacts with the spectator. So, at the end, even though it is a complex perception, the challenge -as McLean (2007) said-, is to build new forms of making an enjoyable programing code screening for every audience and, therefore, to construct and make possible the interaction between a range of different texts, perceiving text as an image, and an image as something that we recover from our historical memory archives.
The Communication Practice in LiveCoding

From an emerging perspective, one can’t consider any human action without a communication practice, where images are created during the interaction. On the other hand, classical communication model consists of a transmitter, a message containing a code, and a receiver. But this model does not help us anymore to perceive what is happening with LiveCoding as an emerging artistic practice. During LiveCoding Practices, both, transmitter and receiver, manifest themselves within a specific context sharing images as the common element that both are capable to enjoy, even if they do not know anything about how LiveCoding is done. They do not need anything to discover common images, because many of them belong to collective memory archives: including the exploration of a logical use of programing code. However, it is necessary to update the communication practices, since models that help us to organize our thinking are not immutable.

Practices

In artistic productions like LiveCoding sessions, which is not a linguistic manifestation but live programming used to generate feeling experiences, there is a chain of riddles that has to be updated by the receiver as well as by the transmitter. LiveCoding sessions are images that belong to the body, as Hans Belting says in his book “Anthropology of the Image” (2007). So the receiver is transformed into an actor instead of being only a contemplative body. This one opens its own archives to activate images to make connection with the code itself and its graphic composition. From this perspective, there is nothing to understand, because there are not messages to transmit, but there are images that are open during the experience of living a LiveCoding session, and are shared in community. On the other hand, the transmitter produces or builds sensitive real-time immediate experiences, and consumes and produces the image as the receiver does it. It is a fact that the transmitter and receiver are presented in LiveCoding sessions not as opposites, as they are presented in the traditional communication model, but as two active elements interacting within a context that defines, perceptively, the programing language used, in this case, “productive or constructive coding”. We do not call it “creative coding” because there is nothing to create, and particularly, because nothing is created if we do not open archives from our historical collective memory. We do not create anything, we produce or build images taking as a start what we have experienced and learnt. But, which are these kinds of images? Are they expressive? Are they poetic? Are they practical? Are they common images? We do not need to forget how we perceive images. Images are contemplated in its widest range of possibilities. We want to say that images are considered as sound and visual, shape and content, particularly, because the shape is already given, so we need to work with the
content, that is a synonym of idea. In this emerging communication practice both, the transmitter and the receiver, become triggers of opening images archives they active on. On one hand, there is a manifestation from the transmitter, which will not only generate images as feelings that the receiver has never experienced, but also will make this person conscious about opening his or her own archives (conscious or unconscious) during the LiveCoding session, while they are making their proposal, manage information, perceive the constructive intention of the images, and the enunciation to recover a historical image body loaded of all their immediate references and their entire historical archives that are not seen in the use of the production. This is the point when LiveCoding, as an image body, generates what we call “new feeling”.

On the other hand, receivers, like the transmitters, but in backwards operation, face the problem to generate images that are going to be perceive by themselves in order to feel them; the issue to identify the transmitter’s production; perceive the goal of the LiveCoding session; feel the crash between, the personal own images opened form collective archives, and the images given by the transmitter. These interactions now acquire a perceptive and generative character, because they address receivers, depending on his immediate and historical images and the fact that both are able to make meaningful the programming constructive code. This is also the moment in which empathy is given between the image body (perceiving the image body as LiveCoding session) and the receiver; thus, both operate on it. At this moment the LiveCoding session is a heap of information that receivers must update, otherwise it is incomplete. As Hans Belting (2007) says, there is a missing link between transmitters and receivers where they do not interact with other system of thinking the image that converge on LiveCoding sessions for the reason that it is riddled with unsaid and invisible things.

**The Image**

LiveCoding sessions are corporal images. They are made using algorithms. It is not given from a context where the distance between transmitter and receiver is like in the traditional communication model. In these, the distance, between the main communication’s actors, does not exist. Instead, the main goal is creating a community. Community is understood as a group of receivers/producers that can and have the opportunity to interact and create a meaningful dialogue during and after LiveCoding sessions. Therefore, the concept of LiveCoding goes beyond sharing the screen. It is the practice where images, generated between code/algorithm and visual/sound results, by the programmer, and the spectator is vital. Where a bond will be created and will last beyond the moment of the session itself.
LiveCoding makes use of programming-codes for the implementation of immediate and unrepeatable pieces for both: programmer and spectator. So, a connection exists between algorithmic writing and the product, as well between transmitter and receiver. The projection and speakers give the space/time bifurcation between the computer and the product; it is what the receiver (audience) witnesses in real time, which result in the modification of instructions, processes, and information that the receiver legitimates the production beyond from an aesthetic or artistic discussion. Thereupon the transmitter is able to establish strategic, as Hans Belting (2007) says: images are democratic and translate them into an action that takes place in a space/time shared by the transmitter and the receiver within an image body. In LiveCoding sessions, there is convergence an emerging way of thinking the image as complex as the image is. It does not matter if it is musical/visual languages, algorithms, digital media, grammatical semantics of the textual body, etc. As previously stated, the communication model needs to be updated. Specially, due of the fact that new practices are emerging, such as the programming code is employed in LiveCoding sessions.

Author/Transmitter/Builder/Actor/Activating

In this adaptation of the communication practice: LiveCoding sessions, authors remain as ghosts operating as archives openers within the image body, in order to be active actors building an immediate and active image or recovering that image from the memory through algorithms. The cooperation between image body and receivers goes away from the ghostly figures of the relationship that they have with regular texts. Authors’ role in a LiveCoding session is present, immediate and irreproducible, since it occurs in real time. From this perspective authors, as consumers and producers of images, are also builders of immediacy, instantaneity, spontaneity, and experimental experiences. Their presence is crucial as trigger of the process that will take place when the receptors are collaborating with the image body, communicating impressions and perceptions, converging on a space/real time, betting on the construction of the transmitters as builders of the simple image body, but complex in their perception and reconstructions of images.

When the receivers open an image from their historical archives, is similar to opening a world of meanings that converge in its conceptualization. Considering the single concept of "salt", say in the immediacy of usage. This opens the door for the meaning of "seasoning", but also reveals its historicity to let us know that, at some historical point, “salt” meant "money", "conservation", "travel", "marketing", "exchange", "sodium chloride", "kitchen chemistry", "laboratory", etc. The concept of “salt” has mutated through history, but that history has not been removed from the concept itself, it has rather been absorbed by it. This suggests the way in which the concept of receivers has
mutated into a viewer/trigger, although their passive role is contemplation. The receivers as consumer and producer of images confront, in the image body’s space, their own perceptions with the perceptions of the transmitters. Their own immediate and historical memories, the elements that have allowed them to adapt to the space/time to get into the more complex conceptualization of the same space/time where now he/she is nothing more than a viewer, but they can act, in the sense of collaborating within the context altering their own perception and the perception itself. However, this trans-mutated Receiver/Viewer/Activating/Actor collaboration is not simple. Perhaps there is a need to build ”a cartography” of this increasingly complex figure. For exploratory issues the reader itself is allowed to open the door, to collaborate in this cartographical proposal.

A) Receiver/Viewer/Activating/Actor Basic Visual/Sound. This kind of receivers are the ones who, first experienced a LiveCoding session and faced the bombing of images systems that they had to interact with, and has two options: accept it or reject it.

1. This kind of receivers accept LiveCoding because they have the pseudo-conceptual skills to experienced, or have the attitude of being exposed to new aesthetics experiences. Aesthetics is perceived as: the first time, the viewer exposed himself to the experience LiveCoding sessions. They are newbies introduced to the world of programming constructing code which converge in building images, sounds, grammar, mathematics, psychedelia, etc.

2. These kind of receivers reject LiveCoding in terms that they reject both: digital technology as a tool which allows to mix, apparently, different images (sound and visual), and to be challenged cognitively in order to be exposed to complex image body that has to be learned in order to be experienced, and at the same time processed.

B) Receiver/Viewer/Activating/Actor Synthetic Visual/Sound. These receivers are neither newbies, nor experts in going LiveCoding sessions or writing algorithms structures. They have cognitive skills capable to live a Visual/Sound experience given by LiveCoding sessions. They are interested in getting involved with constructive processes through digital technology, access to it and see the potential for this process but they do not consider it as art. Thus, these kinds of receivers have the opportunity to access by two approaches to the Image/Algorithm:

1. Examining readily recognizable concepts, since programming code that are used in these platforms are based on structures that are built with English words. So, a simple instruction like
“/*color (255)*/” in the Processing platform can lead receivers to the conceptualization of what is happening in real time. In this case, a visual result through the word “color”.

2. Receiver tend to explore visually any algorithmic result, not as a series of instructions that impact immediately in an audible and/or visual result, but in a series of graphic elements that reminds the textual body exploration. Not as communicative result itself but as graphic compositions and explorations that visual producers like Joseph Beuys performed in some of his paintings in which he wrote a list of objects, for the simple fact that graph words generate an image aesthetic sense.

C) Receiver/Viewer/Activating/Actor Specialist Visual/Sound. These receivers are part of the community; converge in constructing and collaborative processes that accurately communicate perceptions of using of Digital Technologies and Programming Codes experimentally and immediate real experience LiveCoding sessions. They know and manage several programs that are used in these practices and, at least, they are specialists in some of them in two areas where LiveCoding sessions happen: the use of programming code of the image, or the use of sound programming code. They are not exactly Visual Artists. Fitting here, there are professional people interested in the phenomenon of the use of a specific programming languages, and even scientists, who are engaged in design, image construction, knowledge of sound code, exploration of sound, animation, etc. They are productive, and they are generally engaged with the movement, producing, collaborating, managing, educating, disseminating, promoting, offering festivals, and constructing community. This is the highest level that is both: an Author /Sender/Builder/Actor/Activating and a Receiver/Viewer/Activating/Actor Specialist Visual/Sound.

These three kinds of receivers converge on a single space/time and they are classified like this for mere research purposes, but the same receiver may go through the three stages. Perhaps the richest of all receivers and the one in the widest communities, is the Receiver/Viewer/Activating/Visual Synthetic Actor/Sound, in a second instance, receivers tend to access the platforms using programming codes and the community itself, and then transform into a Transmitter/Programmer and a Receiver/Viewer/Activating/Actor Specialist Visual/Sound.

Example

In order to materialize we will explore an example of the Mexican composer/programmer Alejandro Franco Briones. As part of the ideological narrative of the code, this was projected outside the Blas Galindo Hall, the Hall of an important orchestra named “Carlos Chavez”. As critical point of view was intended when questioning the real meaning of an orchestra: What does it symbolize?
And then using a Silvestre Revueltas orchestra piece (1938), that actually was based on Sensémaya’s poem (Nicolás Guillén, 1934) -a curse poem-, the LiveCoding intended to dematerialize this piece, transforming the original narrative and then destroying it and let it penetrate the walls of this Hall.

The code then can be read in three stages, we are going to explore the last two stages, B) Receiver/Viewer/Activating/Actor Synthetic Visual/Sound, when the actors can identify symbols easy recognizable and see the graphic construction of the code itself; and C) Receiver/Viewer/Activating/Actor Specialist Visual/Sound when the actors can perceive the code in a specialized manner, identifying not only the symbols, but also the structures and the objects. As the first one talks about a superficial perception of the code, a newbie will hate it or love it, we are going to skip it for this example.

B) Receiver/Viewer/Activating/Actor Synthetic Visual/Sound Reading. When we skipped the code really fast we can at first identify some recognizable language forms that identifies the ideological intentions of the programmer. In the second 41, a .wav file is called, the lines respond to: /*a=Buffer.read(s,"sounds/laculebra.wav");*/ the name of the file was made for receivers to identify the aspects of “culebra”, a “snake”, then a variable is defined: /*~laOrquestamuerta=(Pan2.ar(PlayBuf.ar(2,a.bufnum,0.8),0))*/ with the name “La Orquesta Muerta”, the “Death Orchestra” using the analogies and some critical lines of things you cannot do inside of an Orchestra’s Hall, the programmer continues to set names of variables that distort the sound of the original version of Revueltas’ piece that he called at the beginning. Names as /*~nopuedecomer.play*/, “it can’t eat”, /*~nopuedesilbar.play*/, “it can’t whistle, /*~nopuedeCorrer.play*/, “it can’t run” continuously appeared and were modified and distorted during the 10 minutes and 15 seconds that the LiveCoding piece lasts. On the other hand, words as /*.play*/, that we have in these example, can be easily identified as something that is being reproduced, as the quote /*.stop*/ that implies something is not supposed to play anymore. With this possibility of reading, transmitters have the opportunity to connect with receivers and send them messages; there is a possibility to connect with people through the bounding of narrative representations inside de text/code. On the other hand, receivers can connect with the graphic composition of the structures, we can see in this example, that the whole real-time experience, and the composition/writing of the algorithms conforms a whole visual composition by itself.

C) Receiver/Viewer/Activating/Actor Specialist Visual/Sound. This stage of code perception becomes a more social construction. Perception is made in community, not only
individually. This is where “LiveCoding practice transforms into a social space” as Michaud (2003), said. The community builds knowledge, and through this, members are capable to perceive a specific language. Mainly, what is happening on the code is that: an audio file is called in order to be destroyed by a sine wave of sound. In the line:

```plaintext
/*~nopuedeComer={Splay.ar(SinOsc.ar((2000..2040),0,0.5))}~nopuedeComer=
{Splay.ar(SinOsc.ar((2000..2040),0,0.1))}~nopuedeComer= {Splay.ar(SinOsc.ar((2000..2050),0,0.1))}*/
```

The variable “nopuedeComer” is making a sine that oscillates, with a frequency that goes from 2000 to 2040 hertz, then with the other lines, de sound waves vary the ascendant way of the frequency values. Later on a low frequency sound is added through a Noise object: /*LFNoise0.ar*/ and /*LFNoise2.ar*/ multiplying the sine. Almost at the minute 6, /*convolution.ar*/ is made by mixing two objects, the file thought the variable named /*~laOrquestamuerta.ar*/ and a sine wave made by the variable /*~nopuedeComer.ar*/ multiplied by another sine. A minute before the end, objects as /*GVerb.ar*/ and /*Ringz.ar*/ appeared making a reverberation in the sound, later on with the use of a /*Pan2.ar*/ the information is reproduced through two speakers, making different sounds in each one. At the end there is repeated convolution between variables multiplying the sound with different amounts of distortion until all the sound stops [/*stop*/].

**Conclusion**

This last example shows the possibilities of these contemporary music/visual sessions. These kind of practices can not be perceive with a simplistic point of view of a work of art that can be sell or that can be held in a museum or gallery context. So, these practices do not need somebody, as a curator but a community that works as a medium of learning process to create not just readers but producers. Music and Visual, in these practices, need to be considered as a whole experiences where visual, sound and narrative process is held, this context is where all kind of texts get together to make something different every time, that can not be repeated it as the same thing. It is a work of art that is constantly changing, and the possible connections between texts defers of the receiver’s knowledge or approaches.

**References**


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PIANO_HOOP: REFLECTIONS ABOUT CREATING MUSIC FROM IMAGETIC SCORES

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Abstract
This paper discusses about the audiovisual performance Piano_hoop which proposes a new way of creating music from combining data art and aerial acrobatics. It has resulted from a research involving metaphorical and subjective correspondences between musical and “imagetic” experiences. Based on Vilém Flusser's ideas, art articulated with musical perceptions from a phenomenological point of view, and inspired by John Cage's artworks, this organic system is formed by imagetic piano scores, an aerial hoop and body movements. By analyzing its conception and its first experimental results we can reflect about data art visualization, image epistemology, contemporary music, and hybrid models in a way for producing transdisciplinary arts.

Keywords
Imagetic scores, piano scores, data art, aerial hoop, image epistemology.

Introduction
The piano_hoop performance is a result of my visual arts Master's Thesis Partituras Imagéticas: Uma Poética Visual Através da Imagemúsica (Imagetic Scores: a visual poetic from imagemusic) which aimed to envision an art of poetry that translates music into images from musical scores.

By joining concepts from the epistemology of images and musical perception based on the authors such as Vilém Flusser, José Miguel Wisnik, Hans Gumbrech, among others, the study questioned and rethought musical notation as a visual representation of the music. And, as a practical development of this research, experiments were performed in order to reconfigure musical scores into new imagetic representations.

Finally, we reached a hybrid result which brought together different poetics into one artwork: musical images (produced by the research), aerial acrobatics, and a performance of a body functioning as the gearing of the entire organism. Using imagetic scores, Piano_hoop therefore proposes itself as a dynamic sound creation system.
Imagetic scores: the philosophical conception

The visual composition used in the performance was resulted from my investigation of recoding music score data into images.

The motivation was the fact that the score is typically considered a musical representation in the quality of an image. However, considering that this notation provides accurate information for executing a given piece in an explanatory narrative format, the musical score can be understood as a (musical) text.

In this context, Vilém Flusser's (2007) thought about the differences between text and image can greatly contribute to the deepening of this notion.

The author argues that man has reduced four spatiotemporal dimensions into just two, which could be considered the beginning of images. Later, he reduced two-dimensionality into only one dimension, creating the text that converts images into linear explanations.

Consequently, in terms of the apprehension, text and image show some differences. Before a text, the reader needs to follow pre-determined directions and meanings through its lines to understand the whole message. On the other hand, in front of a painting, the viewer can perform a quick overview to understand it or gaze it in subjective directions.

That is, an image allows the eye to view a synthetic apprehension and posterior analysis in a free and circular way, with reversible meaning relations. However, the apprehension of text occurs in a linear, focused, and objective manner (FLUSSER, 2007).

This contraposition reinforces that scores have an objective and restrictive character. In fact, musical notation requires a previous knowledge of the code to be deciphered, it cannot be grasped in a synthetic visualization and it has a strictly informative character. So, as text is a "metacode for images" (FLUSSER, 1985), the score is intended to explain the music. Therefore, in the same way that texts do not contain the magical character of images, the score cannot contain the subjectivity of the musical experience.

That being said, the research idea was to break up the information contained in the musical text and recode it to substitute the semantic character of the text by the presence of imagery based on the thoughts of Hans Gumbrecht. To the philosopher, the “meaning aspects” deal with the semantics and the “presence aspects” refer to the materiality. Gumbrecht believes those are layers in permanent tension, but in some cases, which one is ascendant: reading a text, the meaning is
dominant, different from listening to music, when the presence is the most predominant aspect (GUMBRECHT, 2010).

From the opposition between aspects of meaning of the text and presence of the music we can conclude that the score, a music text, is not a sensible music representation. Furthermore, considering the experience of time that those abstractions can provide, it can be said that music is closer to image than to text.

Writing builds linear and objective cause-effect relations, and, because of that, it is possible to measure an average reading time. As to images, the composition allows the “eternal return” of the gaze that creates a circular understanding. Therefore, the time experience is subjective and immeasurable, because it depends on the viewer.

In the same vein, Wisnik says that music provokes a subjective experience of time, which is chronologically immeasurable. The musician states that the rhythm is not linear, but an oscillation of different times. It arises and absents like it was out of time, in a “virtual time, another kind of time” (WISNIK, 1989, p. 68).

According to Walter Gomide (2003), music stimulates a particular experience of time. From Hegel and Santo Agostinho, Gomide thinks that music can provoke a peculiar sensation able to suspend the linear perception, and project the soul out of the present.

Thus, considering the difference between the (image) subjective time and the (text) chronologic time in relation to the music, image and music have a trait in common: both cause a circular, subjective and immeasurable experience of time. So, it was the fundamental idea used in the research to graphically translate musical texts into images.

Considering the research aims to translate piano scores into image, it seems to overlap the data visualization matter. At first, to understand this combination, we must point some conceptions such as “mapping” and “visualization” in the context of art and design.

According to Lev Manovich (2004), “mapping” is the transformation of one representation into another. It consists in a wide process of recoding data. So, “visualization” is only one kind of mapping, in cases in which the data originally is not visible and the mapping that turns it into images.

Based on this explanation, “visualization” can be described as a mapping in order to recode data into a simple and understandable visual organization.

However, in a contemporary art context, data visualization has a different purpose, that can be understood from Flusser ideas about the social function of an artist. In line with the philosopher, the contemporary artist is not exactly a creator, but a player who plays with pieces of available
information to promote dialogues with the public and with himself. In this sense, the artist plays against what is predictable. He intends to break hermetic schedules to produce new information (FLUSSE, 2008).

So, if data visualization tends to simplify information to attend semantic goals, the data art, on the other hand, has a different artistic intention. In general, it plays with those huge data quantities to produce images, situations and experiences in a subjective goal, for questioning or expressing feelings about issues that the pragmatic technological life cannot answer.

Furthermore, we must observe that computers use the same numerical code to represent data, what makes easy to recode one representation into other: 2D files into 3D files, songs into images etc. This ability seems to support the artist subjective, but actually it conducts the mapping choices. In the end, those choices are not motivated by the data content, but by computer tools possibilities. Mapping choices thus seem arbitrary (MANOVICH, 2004) and predictable by the software.

Another important question worth posing is about arbitrary versus motivated choices in mapping. Since computers allow us to easily map any data set into another set, I often wonder why did the artist choose this or that mapping when endless other choices were also possible. By allowing us to map anything into anything else, to construct infinite number of different interfaces to a media object, to follow infinite trajectories through the object, and so on, computer media simultaneously makes all these choices appear arbitrary – unless the artist uses special strategies to motivate her or his choices (MANOVICH, 2004, p.141).

As reported by Manovich, in a good work of data art, the content and the context of data must orient the mapping. From this point of view, the research for translating music “lines” into “surfaces” can be considered as a data artwork because its visualization is based on music subjective perceptions from piano scores. The music data motivated the mapping visual plasticity. Besides, in the research’s practical part, there were no computer tools in the beginning. The mapping shape was totally made by pencil, with no digital or electronic interference. The computer was basically used to explore the visualization potential in other dimensions, in a posterior stage.

Consequently, this mapping was not arbitrary but deliberately developed. Hence, it can be discussed as a strategy to use technology without losing autonomy, but preserving the artist subjective intentions.

The experiments

After discussing about the poetic dialogue of data content and its visual representation, the practical part of the research was all built up in a metaphorical symbolism between music and image.
The first central idea for building the experiment structure was the circular and subjective feeling of time, caused by the music and by the image.

The horizontal lines of the piano scores were then remodeled into as circles. Thus, the treble clef (five parallel lines representing high notes), and the bass clef (five parallel lines for bass notes) were curled. So, the representation had no sense of beginning or ending anymore. Time loses its successive and measurable character, becoming subjective and especially nonlinear.

The second feature considered was that the pause is sometimes present and absent in the conventional score, although the contrast between sounds and pauses is what makes music indeed. So, the pause is permanently visualized in the musical representation, in correspondence with the time circle.

The new code for translating music into image are also some other concentric circles. Those ones that are external to the pause circle represent the expansive songs from the treble clef. On the other hand, the internal circles represent dense notes from the bass clef.

After putting the score notes on those circles by pencil as little dots, one handmade line connects them from clefs circles to the pause circle, always in alternate pattern: “note, pause, note, pause…” successively until the line touches its other end. Then, music data, originally organized in score lines, become surfaces.

The last step was to choose color effects. The basis for corresponding colors and music was the main piano character: it can play many notes/voices at the same time, that’s why the piano is called a harmonic instrument.

Considering the purpose of designing visualization by analogy with music perception, the effect expected was that, like in music, the visual harmony had quite a contrast with the rest of the image.

So, after defined the chromatic effect that would liked to be obtained, it was necessary to determine exactly how the colors would be chosen.

Although the created visualization was based on musical perception, after establishing how the mapping would be done, the data transcription became an objective process and, in a sense, mechanical. Therefore, as a way to strengthen the subjective aspect of this construction, the following process was established for color selection: immediately after observing the work, while still under the influence of the music, I photograph colors and textures that remind me the musical piece. Thus, my sensitivity in the specific environment creates the map painting.
With the palette of colors determined, the color records were then digitally and experienced on the musical map layers, contemplating the painting methodology previously explained, to show the harmony of the piano within the image.

This methodology for painting, in the end, incorporates into the mapping: intuition, chance and my sensitivity at the time of the musical performance. Thus, as the musician interpretation is influenced by place where he/she is performing the piece, the image of the work may also be colored in different ways, depending on the environment in which it is developed. Therefore, this could be considered as an artistic methodology of painting musical images (figure 1).

Figure 1: Minuet No.2 from J.S. Bach, in imagetic scores

Furthermore, by bringing the images into the digital environment, it was possible to deploy them in multiple outputs, the first being in the form of digital projections. In image editing software, the surfaces were edited to separate them into three layers to represent the treble clef, the bass clef and the surface of the harmonies. Thus, it was also possible to obtain vectors and produce objects capable of causing a sense of three-dimensionality.

In the end, musical data can be experienced in different dimensions, analogous to the abstractions and multiple dimensions discussed by Flusser (2008): three-dimensionality (the world), two-dimensionality (the image), one-dimensionality (the text) and zerodimensionality (the virtual image).

**Piano_hoop: The final experiment**

Piano_hoop consists of a circus performance that simulates the interaction of the body with the surfaces developed during the research. Its goal is to envision an experimental process of musical creation from the visual dialogue between music and image, activated by body movements.

It is a dynamic system formed by the movements of a body that, on top of a circus ring, receives digital projections of the images created in the previous experiments. According to the interaction with the projections, the body of the performer activates the sound or piece of music that
is represented in that area of the image. Thus, the mapping of musical text into image creates an experimental virtual piano (Figure 2).

![Figure 2](image)

The projected images end up functioning as, as I call, imagetic scores. Although illegible, they store information about the piece *Minuet No. 2* by Bach and, depending on how they are played, it can either sounds like the original music or produce a new sound combination.

The idea for this work arose during the study of *4′33″* by John Cage in which the musician sits at the piano and does not produce any sound for four minutes and thirty-three seconds. However, different than the expectation of listening the silence, the sounds produced by the audience are heard, such as the noises of feet on the floor or the rustle of chairs.

Thus, the piece incorporates the random noises produced within the environment in which it is "executed". However, its score does not contain any notes, it only consists of an empty music staff.

The study of Cage's work provoked a curiosity: how would the imagetic score of *4′33″* appear? In other words, what would be the visual resulted of its musical data if developed by the code in this research?

The mapping of silence was then performed. By not containing notes, its musical map did not generate shapes nor colors. As in the original score, only its primary structure was visible, in this case, the pause circle.
It is possible to see that the structure of the created code, being similar to a circle, coincides with the shape of an acrobatic hoop, which is an acrobatic circus instrument also known as an aerial hoop.

The interesting thing about this coincidence is that, if experienced in this context, the hoop helps to extrapolate the two-dimensionality of imagetic scores, because it presupposes the use of a body able to explore movements in all directions.

Thus when working with the hoop, beyond the width and height of the two-dimensional projections, the body was able to explore depth by passing through space. From this perspective, the third dimension, which did not initially exist in the imagetic mapping of the scores, was then incorporated as a new parameter for musical creation.

In addition to the images assuming a new three-dimensional potential, the visual dialogue with the sound can also awaken a new perception of the projected images. In the words of Hans Belting: (...) the musical accompaniment, as provided for in silent movies by a pianist, also modifies the experience of the images in that they become different when a distinct soundtrack shapes the impression they make on our feelings (BELTING, 2006, pg. 39).

The sound interferes with the apprehension of the visual stimulus thereby causing a new imagetic experience. Thinking in this way, the proposal was to experience the images in an audiovisual environment for them to be presented as a collaboration of musical information and also to be perceived in a new way, in a multisensory context.

Another new element in this context is the presence of the body. And to understand the various roles it plays in this work, a brief distinction between image and media must be given.

According to Hans Belting (2006), the image is the objective, which is to be displayed, while the media is the object, the means by which the image is transmitted. Therefore, without the media, there is no image.

For the author, the tendency is to perceive image and media as a unit. However, for analytical purposes, it is necessary to isolate the image from its surrounding transmitter.

From this perspective, the body assumes multiple functions in Piano_hoop. First, it is a producer of images, it creates the images of a body within the scene and of its shadow over the projections on the wall to form a visual composition behind the hoop. Furthermore, it accumulates
the function of the projections supporter, as a medium. Thus, in this experiment, it can be said that the body is a living media (Figure 3).

Finally, the body also acts as a fundamental gear for the aerial piano operation. In symbolic terms, it activates the image and plays the music, thereby it plays a didactic role to unveil the sound contained in the imagetic scores and the various possibilities of sound creation.

Thus, the system, which at first presents classical music, can be subverted by the performance itself. As the body performs movements to produce a linearly continuous sound, the piece is played in its original format. However, by letting the stunts be performed with focus only on their own movement without the worry of playing the original music, randomness becomes present which de-automates the system and creates new music.

The noises, the pauses, and the permanence of the same notes are some of the sonic results of this experiment. That is, in addition to harmonic rules and other music theory assumptions, silence and other elements used in contemporary music are incorporated into the new musical composition.

Finally, with regard to the methodology of the work, the four musical maps of Minuet No. 2 were alternated every 20 seconds to fortify an experience of circular and imagetic time.

To define the sound presented in the performance, classical movements of aerial acrobats were researched and chosen. These movements were performed and recorded on video. Later, the film was compared to the musical map to find out which sounds the performance would produce if it were
activating the image live. Thus, the musical result of this work was produced and incorporated into the performance video.

Therefore an interactive program that translates the movement of touching (the images) into sound is a possible development from this research. Thus, the performance could evolve and create live music.

**Conclusion**

*The musicalization of images and the imagination of music can be observed since at least the early twentieth century (abstract painting, modern music scores) but only our image synthesizing grandchildren will actually be able to compose chamber music with images.*

_Vilém Flusser_

The research that resulted in the performance pointed to two relevant considerations in the investigative field of interfacing “music and image”. In epistemological terms, the fact that the score is a visual representation does not guarantee that it has the characteristics of an image, that is the reason for using the expression “imagetic” and not “visual” for the experiments.

Furthermore, by comparing music scores to text and to image, in relation to its intention and its message apprehension dynamics, it was found that objective, linear and semantic musical notation consists of a kind of text.

Thus, in order to reconfigure the notation according to imagetic propositions, initially its data was graphically remodeled on sensitive surfaces for free interpretation. And when mapping the data from the piano scores to new graphic arrangements, the research touched on "data visualization". However, to subvert the informational and technological tendency of the data visualization, the experiment approached the movement of data art (artistic visualization of data).

Thinking about circular time as the main correspondence between music and image, the textual aspects of the music notation have been suppressed to make way for a musical representation with the intentions of an image in order to allow visual syntheses, circular analyses, and subjective apprehensions. Lines were transformed into surfaces. The imagetic scores were born.

Later, when moving to digital environments, the surfaces were turned virtual with the potential for multiple developments. Soon they could assume various shapes and have multiple dimensions:
the one-dimensionality of the text, the two-dimensionality of the imagetic surfaces, the zero-dimensionality of the technical images, and the three-dimensionality suggested by the sculptures.

Finally, in order to go beyond such processes, the images developed during the research were experienced in a spatial situation, in the *Piano_hoop* performance, with a kind of virtual piano that, instead of containing keys, consisted of musical maps. Its goal was to present a new way to create music through imagetic scores activated by aerial acrobatics. By combining different art expressions, it also anticipates the prediction by Flusser as presented in the epigraph of this conclusion, that only his grandchildren would be able to compose music with images.

Therefore, it is possible to make a metaphorical analysis of this final experiment which summarizes and responds to the questions raised by this research. It can be said that, in *Piano_hoop*, the piano has the symbolic function of a musical black box. The score is its rigid programming that is deliberately subverted via data art. And, finally, the results of the performance, its images, musical creations, and poetic reconfigurations unveil themselves as the unlikely product of this whole system: the new information.

References


FOOD FOR THOUGHTS: SHOULDN’T BE BOUNDARIES BETWEEN ART, TECHNOLOGY, GAME ART AND INDIE GAMES?

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Abstract
This article seeks to analyze issues related to art and technology, with emphasis on game art. The term game art is used nowadays in reference to types of games designed as art projects, whose meaning holds a close association with the idea of indie game. To talk about games and art it is necessary to highlight more issues, as the art context and the circuit of contemporary art; the relationship between art and technology; visual components; images created to this games. In this sense, the reflections can be extended to the field of visual music, once deal with association of visual and sound elements in digital platform. Instead being just a search for answers, this study aims to raise some questions that will contribute to the thinking about current art.

Keywords: art and technology, game art, indie games

Introduction
This article is an excerpt from my current doctoral research in visual arts that in this early stage focus on a better understanding of the elements that constitute the universe of contemporary art, art and technology and game art, and the possible intersections between them. First, I would like to define the term art and technology, this concept is used here to refer to all artistic production that uses the computer as a system and not just as a tool. There are other names also in use as computer art, digital art, media art, new media art, electronic art, art and science, and others, however, I will use in this paper the term art and technology. The game art works are already inserted into the context of art and technology, nevertheless it is distinguished from commercial games, and the game art is thought of as an art project, which approaches to the idea of independent games, the so-called indie games.

Just as game art does not obey the videogame rules, the production in art and technology also operates in a distinct logic of using technology promoted by industry. Although game art and art technology dialogue directly with the technology and the entertainment industry, they still into the context of art. Their focus lie on the aesthetic experience, which is not the same as visual effects. For Edward Shanken, a theoretical and historian in the art and technology field, the new media art (a term he defends), created its own circuit circulation and dissemination of its production, and in this alternative circuit to the mainstream of contemporary art that game art circulates.
In the earlier years of the art and technology history, the art works were based, mainly, in experimentation, to find out how to use the computer to produce something with some visual interest. The exhibition Cybernetic Serendipity at the ICA in London in 1967 is considered until now a milestone in the history of art and technology, but despite being a success, it deserves corrections about the lack of critical character on the technology that arose. The theoretical Usselmann Rainer (2003) wrote a long essay analyzing Cybernetic Serendipity exhibition and the context in which it was exposed. Usselmann confronts the positions of the critics of the time that in one side considered the exhibition as a landmark in the history of art and other that neither considered an art exhibition. This situation is very similar to the reaction generated after the MoMA announce the acquisition of videogames in 2013, there are enthusiasts with news and those that considered inconsistent an art museum acquire videogames because "obviously" it would not be art. There is a space of fifty years between these two episodes, but the public reaction still quite similar. In the sixties technological innovations were toward the army and weapon developments, and the cultural context of the time was facing an anti-war movement, which according to Michael Rush would be a possible reason for the major artists of the time do not adhere to computer art and the mistrust by the public towards this production:

This occurred in part because of existing anti-technological feeling among the exponents of the counterculture and the artists of the mid-60s and 70s. Various environmental and anti-nuclear groups were protesting against government experiments in technology and nuclear power, which may have obscured the experimentation Art with computer technology45. (RUSH, 2006, p.170, apud. GASPARETTO, 2013)

Although today this anti-technological feeling is no longer as it were back then, the impasse between contemporary art and the art and current technology can be possibly caused by its approaches to technology and entertainment industry and more intensified in the case of games and game art. The "rejection" of art and technology in what Shanken calls the mainstream of the contemporary art is one of the themes he proposes to investigate. He believes that they have more similarities than we think, because in both contexts the concern is with art, with the poetic, however, the critical frequently fall in the use of technology, and forgetting about the art. Moreover, in the art and technology’s attempt of come to the circuit of contemporary art it creates a specific circuit for art made by computer. This

45 Free translation from the portuguese: Isso ocorreu, em parte, por causa do sentimento antitecnológico existente entre os expoentes da contracultura e os artistas de meados dos anos 60 e 70. Vários grupos ecológicos e antinucleares protestavam contra experimentos governamentais em tecnologia e energia nuclear, fato que pode ter obscurecido a experimentação artística com a tecnologia do computador.
medium began gaining ground in the universities and in some festivals and fairs. Today there are already numerous events focusing on this production as FILE - International Festival of Electronic Language, Ars Electronica, Trasmediale, ISEA (Inter-Society for the Electronic Arts) among others.

![Figure 1: The game Passage.](image)

**Gamification**

The gamification can be briefly described as the application of game logic, the game thinking, for activities other than games. The challenge, scores, badges, level up and rewards are common features in videogames and games in general. The application of this dynamic in activities that do not involve games is what defines gamification, gameficate a non-game action. Games are now the exponent of the entertainment industry, and can gamification be considered a "phenomenon" (cultural?) or just a recent trend? This query about games and the play element is already presented for some time, and was masterfully analyzed by Huizinga when he wrote his most famous book Homo Ludens in 1938. While it may be questionable in some ways, Huizinga shows role of the play element in the development process of our civilization.

The play idea advocated in *Homo Ludens* is a free and disinterested action, with the end in itself with no material gain, which promotes everyday suspension, and one of the most significant (human and cultural) aspects of play is that it is fun. In one hand, the play element is the opposite of gamification and in the other, it is almost the same thing. Gamificate an action is to assign points and goals to achieve a desired target, and have fun in the process. There are many positive results in many areas that use of gamification like, study, lose weight and save money for an example; these activities can become more fun and rewardable. The recycling company Recyclebank encourages its members to recycle their waste through challenges with sensors control in the collecting bins The community
that reaches the target accumulate points to exchange for eco-friendly products. The app Zombie Run from the company Six to Start is also a fun example of gamification, it turned the running into a simulation fighting a zombie attack, the faster you go more help and ammunition you will get to distribute to survivors of the "attack" of the undead. Undoubtedly a fun way to exercise. Gameficate is nothing else but give a new motivation, inserting the play element in an activity already known, that sometimes can be boring, but it does not make us "spoiled"? Will we only make something for fun or to win something in return? For now, gamification is showing benefits, but we must be aware of and reflect on our responsibilities even if they are not fun.

The PhD Professor Suzete Venturelli understands gamification in the art and technology context as a way to resize the playful nature of the artwork for the spectator or interactor could became a player in a genuine experience of art in an entertaining way. The Extinction! project was developed by Prof. Suzete with the MidiaLab group of the University of Brasilia, and the project's concept is a claw crane (also known as crane machine) that saves golden lion tamarins from extinction. Unfortunately the actual rescue of the species is not so simple, however as a work of art Extinction! send donations from the players to the NGO Greenpeace to cooperate with efforts to preserve the golden lion tamarins. Players need to buy a card to use the claw machine, there will be available in various plastic balls with the image of a golden lion tamarin, but this is an augmented reality marker (AR). An AR device is attached in the machine, so the player can view in 3D a golden lion tamarin that he "saved". Extinction! was exposed in July 2014 in the Paço das Artes in São Paulo, Brazil, besides de claw machine and the AR device, further information about the golden lion tamarin were available to enlighten the visitor about endangered the animal runs and the actions are being made to help save it. While visitors have fun playing and "saving" the tamarin, it will also help effectively the cause, is not a mere entertainment, there is a critical action. Extinction! does not qualify as a game, but incorporates the idea of gamification, the play element is there. All the elements in Extinction! like the lights, colors, and the crane machine itself, say that it can be in an amusement park, it is supposed to be fun. An art exhibition can be a place for fun and entertainment without losing its cultural relevance.
The technological innovation rules the gaming industry is in both graphical representation as in the processing capacity of the consoles. The game art and indie games do not follow the same trend of commercial games, they look for a new experience in playing, a distinct aesthetic experience. The visual aspect is important in both cases however, it is developed differently in each one. The 8-bit games are now obsolete, but back in the de 80’s it was the state of the art at that time but the technology developed a lot since then, the games now are far away from that, the high definition of the graphics nowadays is the rule, almost mandatory in the game industry. Games as Diablo III impresses us with their realistic animation and for this kind of game, the level of realism intensifies the game experience. Passage is a recent game, however it is a 8-bit game, and can be considered a great success, because is not the technology itself that is important in this game, but the aesthetic experience that is distinguished of the mainstream games. Passage is about the time, the player’s lifetime; this pixelated image is enough to make us think about our life. This subject isn’t new in the art history, for century artist are concerned about the time we have to live, the eternal desire to be immortal, and Passage tell us this in a playful way, that catch the players with “simples blocks”.

Monument Valley is a beautiful game that invites us to enter the Escher world. The game is based on drawing from the graphic artist Escher, who is known for his drawing with impossible architectural constructions and infinity forms. Monument Valley is considered a indie game, but when we play it, it amuses us, make us think of it as a work of art, not just because it was inspired in a famous artists, but because of the aesthetic experience that the game provides. The game doesn’t give us any rule or explanation, in the act of playing you are taught how to keep playing it.
When I began my academic research on my master degree about videogame and art, the game art definition seemed quite clear: it were games with artistic proposals, which were thought of as art objects. After a few years, I am no longer the same certainty in the definition. The novelties in the field of games is very intense, more and more programmers, artists and independent studios producing games that are not among the giants of the gaming industry like Ubisoft, EA, Blizzard for example. Consumers also produce; smaller companies can develop games even without high technology. These more poetic games with a different aesthetic, as a new gaming experience are called indie games. They are independent from the dominant game industry, and that has gained many admirers and end up blurring or even undoing the category of game art and indie games. However, to be honest, is in fact required such differentiation and categorization?

Game arts or indie game usually have a different visual, they do not follow the mainstream industry with impressive 3D graphics, they try to explore another kinds of visual interfaces. There is a whole world of gaming possibilities there is no necessity to stick just with one.

Figure 3: The game Monument Valey

When talking about new gaming experience worth mentioning John Dewey who comments on the art experience, which is to think with colors, shapes, with other codes that are not words, just like gaming:

Think directly in terms of colors, tones or pictures is a technically different operation of thinking in words. However only superstition is able to say that, the meaning of the paintings and symphonies cannot be translated into words, or poetry in prose, thought is monopolized by
language. If all the meanings could be expressed adequately in words, the arts of painting and music would not exist. There are values and meanings that can only be expressed by immediately visible and audible qualities, and ask what they mean in terms of something that can be put into words is to deny its distinct existence. (DEWEY, 2010, p.167)

Game arts (or indie games or whatever) such as Passage, Flow, Journey, Monument Valey, Limbo, Machinarium are games of unquestionable artistic nature, are unique experiences as a game and as artwork. Talking about art is talking about the image, and how it is being processed during this entertainment era. Is not just the computer image that changed, but our perception too, we expect that games must be more realistic. Besides the sophistication of the computer image, the games opened a huge space for creation that does not need to follow in just one direction, it can expand for many areas like it already does, and it also reached the art world.

Passage Jason Rohrer and Flow of That Game Company already received the "art credentials" to be acquired for MoMA's collection in 2013, even though it was for the design department the initiative raised the question of games being an art form. For many students and researchers of the game art area, the game can be a medium for art since ever. Here in Brazil the #ART events - International Art and Technology Meeting which started thirteen years ago and still happening each year since then at the University of Brasilia legitimates this production as art, as well as FILE - International Festival of Electronic Language is happening in Rio de Janeiro and Sao Paulo, with special editions in other states over a decade. The annual exhibition presents many kinds of works in art and technology and game arts were usually there. In recent years, the FILE exhibition dedicate a special area just for game arts called FILE Games.

The GameLab UCLA is a research lab in games where the goal is the emphasis on conceptual risk-taking and development of new modes of expression and form through gaming. In their own words, they develop game art. Perhaps another way to clarify or to point out these differences is the idea of dazzle and enchantment studied by Professor Cleomar Rocha. Professor Rocha says that even if dazzle can mean fascination, the originally meaning is to confuse the sight by excessive brightness. Is in this point that he makes a statement about being dazzled and enchanted by a game. The state-of-

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46 Free translation from the portuguese: Pensar diretamente em termos de cores, tons ou imagens é uma operação tecnicamente diferente de pensar em palavras. Mas somente a superstição é capaz de afirmar que, pelo fato de o significado dos quadros e sinfonias não poder traduzir-se em palavras, ou da poesia em prosa, o pensamento é monopolizado pela linguagem. Se todos os significados pudessem expressar-se adequadamente em palavras, as artes da pintura e da música não existiriam. Há valores e sentidos que só podem ser expressos por qualidades imediatamente visíveis e audíveis, e perguntar o que eles significam em termos de algo que possa ser posto em palavras é negar sua existência distinta.
the-art technology in videogame dazzles us, it is fascinated, but it takes a little more to be enchanting. Of course, that it is not the same for everyone, something can enchant someone and dazzle the other one, but the point is this slight difference between being fascinated and enchanted. A game art can enchant its players even if it not fascinated the whole audience. This is very personal, like art itself.

The cultural interest in technology becomes more and more, whether in the constitution of social experiences, whether as a measure of their understanding, development and innovation. In this way is capital to recognize those elements that dazzle and enchant to recognize the legitimate vectors of social and cultural development.47 (ROCHA, 2014 p.86)

The visual elements are important when we think about art, but in games, the visual is stuck together with the interactivity. Moreover, this is what games stand for, interactivity and fun, and whatever more we can create with it.

**Conclusion**

The researcher Debora Gasparetto in her book "The 'short circuit' of digital art in Brazil" (O 'curto-circuito' da arte digital no Brasil) makes a detailed analysis of the context of art and technology in Brazil, and describes the process in which it is creating its own circuit for art and technology. Due to the difficulty of the traditional means of contemporary art to understand the new language that was emerging in the latest decades, which came to be added in the contemporary art field, but ended up creating its own circuit to achieve their legitimacy. Edward Shanken also examined the same issue on a global level and it can be seen that as the art and technology tried to enter the canon of contemporary art it ended up creating its own circuit and canon. The games today have their canon too, and the indie game or game art are beginning to elect their. Gamificating or not our actions the games are everywhere, including in the art, fascinating and enchanting players. Is up to us, students and researchers, to write or coding our next step and keep playing it.

**References**


47 Free translation from the portuguese: O interesse cultural pela tecnologia torna-se cada vez maior, seja na constituição de experiências sociais, seja como medida de sua compreensão, desenvolvimento e inovação. Neste aspecto, reconhecer os elementos que deslumbram e aqueles que encantam torna-se fundamental para reconhecer os vetores legítimos de desenvolvimento sócio cultural.


THE EXPANDED FIELD OF SOUND AND IMAGE

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Abstract
Within the realm of the expanded field as approached by Rosalind Krauss, this study refers to the hybrid art beings that might advance from the intersections between sound and image in contemporary circuits. In this initial stage of the research we will be sharing more of a panoramic view of this opened ground of inquiry and experimentation. It’s multiple derivations can be perceived through works that inhabit interdisciplinary spaces within and outside art institutions.

Keywords
visual music, sound art, sound installation, plunderphonics, expanded field

Introduction
The possibilities that came from the registration and edition of audio material, have outgrown and derived into somehow more characteristic areas of knowledge and experimentation. The ingredients of the interdisciplinary hybridism of sound and image can go deeper as to create an expanded field that enables these contaminations to keep on happening.

The interest of this study is in maintaining those investigations in an opened intellectual atmosphere without the attempt of putting them into constrained boxes of signification and taxonomy. The interaction between different areas of knowledge in the making of such works is in itself interdisciplinary, just as many of the creative projects being done in the expanded field of sound and image are collaborations in a team-like approach.

A significant aspect of this expanded field is that artists create not only processes and objects but also the instruments, machines and circuits themselves. Many times inventing codes and networks that didn’t really exist before.

Expanded Fields
According to Rosalind Krauss the “modernist demand for the purity and separateness of the various mediums (and thus the necessary specialization of a practitioner within a given medium)” (Krauss, 1979:42) as a formalist discourse starts losing its interpretative power when in presence of some works of art already midst 1960’s. To the author:
(...) the ideology of the new, its covert message is that of historicism. The new is made comfortable by being made familiar, since it is seen as having gradually evolved from the forms of the past. Historicism works on the new and different to diminish newness and mitigate difference (Krauss, 1979:30).

In “Sculpture in the expanded field” Krauss is trying to articulate, theoretically, the complex passages, not at all linear, from modernist understandings of art to postmodern ones. The historicism impregnated in art criticism was one of the concerns of the author, for whom an evolutionary point of view is not a fertile interpretative tool regarding art manifestations. When in face of works that started defying conventional standards and consequently destabilized known frontiers, questions around definitions and taxonomy were inevitable.

Observing the intrinsic relations between sculpture and landscape in the way we determine where they lodge, Krauss proposes an analysis of that construct from the perspective of its logic expansion. From oppositional categories surrounding and helping situate the concept of sculpture (not-landscape; not-architecture; not-monument) we arrive at an analytical scheme that encompasses a determined context without the negation of intersections.

The theoretical proposal of the expanded field allows us an interpretative complexity capable of absorbing and articulating, in feedback, the dynamics of arts. All in all “within the situation of postmodernism, practice is not defined in relation to a given medium - sculpture - but rather in relation to the logical operations on a set of cultural terms, for which any medium - photography, books, lines on walls, mirrors, or sculpture itself - might be used” (Krauss, 1979:42).

**Experimentalism and Externality**

The openness that comes with the expanded field relates the praxis of experimentation to the externality of the meaning. Experimentalism is an integral part of the constitution of expanded fields. It is significant to point at least two approaches to experimentalism that may not be completely contrasting, but that are different in purpose, distant from each other in its procedures and restitutions. The nature of the experiment as in the epistemological model of the western modern natural sciences is associated with laboratories and formulas. Trials are planned, documented and controlled. They aim a result. A result already known or imagined.

In another direction experimentalism has frequently been associated with practices with a transgressive character, in which behaviors, models and delimitations firmly established are put into question. Experimental, then, means a critical attitude in relation to what is consolidated and is accepted as artistic reference, forcing an
opening to the incorporation of relatively strange elements in a certain field of art (Iazzetta, 2014:4).

What might be thought of as an error in one scenario, can occupy different places within the creative process arranged in a diverse setting. In some projects, the error is absorbed and its consequences will derive further material for exploration and recombination. In this approach the manipulation of materials and proceedings from the perspective of trespassing codes and methods, is valuable in its own terms. It is the very source of inspiration for new endeavors and challenging situations. It carries a boldness that keeps an artistic language alive, questioning its elements and strengthening the relations that forge it.

By the externality of the meaning, furthermore, the author means the direction in which many of the art pieces were proposing that the meaning, the significance be seen as originated from a public, not a private space (Krauss, 1998). Not so much the internal biographical descriptions, but socialized, accessible topographies.

Krauss is, above all, enrolling a line of thought that rejects the illusionist art, that which still influences the ways of seeing art today. The meaning of an intent to destitute illusionism cannot be separated from the significance of an occidental point of view. Its rejection implies in a revision of the notion of the constitutive consciousness of the object, as well as the pillars of a private and inaccessible subject. It’s the refusal of a consciousness that precedes the experience, of a psychological model in which the subject is already embedded in signification before actually getting in contact with the object, with the (external) world.

Externality expresses itself as openness to the actual space-time, indicating a new relation of fruition, one which delivers itself within the journey, in the very process of perception and knowledge. The externality of the meaning can also be understood as the problematization of the place of the artist as the main agent responsible for generating and organizing the meanings of a work of art. Instead, there is an openness into an horizontal panoramic view not only of readings and interpretations possible, but of collaborative propositions and networking practices that utilize contemporary technologies and institute authorship in a more collective manner.

In a phenomenological perspective, perception and thought are coextensive, therefore, the body would be the very place of signification. The phenomenon recognizes this ontological simultaneity between the perception and the object being perceived. It understands the perceptive

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48 All text not originally written in English was translated by the author of this paper.
experience as constitutive of the subject, as a “field of presence, in the broad sense, that expands according two dimensions: here-there and past-present-future” (Merleau-Ponty, 1994:357).

That is how the distance from the historicist formalist perspective is established in the direction of an understanding of art in relation to its environmental situation and in a constant dialogue, in a possibility of closer relation between art and life, in an “I that is understandable through experience” (Krauss, 1998:319). Phenomenology invites: “Let´s return to the sensation and observe it from such a close distance that it teaches us the lively relation of the one which perceives the world with the body” (Merleau-Ponty, 1994:281).

**Music, Noise, Silence**

The expanded field as a theoretical apparatus has the ability to endorse a number of arts, creating a kind of neighborhood encircling determined modalities. Possible parameters for oppositions surrounding music could be not-sound, not-noise, not-silence, for instance. And the ground within these correlations presenting fertile operations as well.

Music as an institutionalized field of knowledge, academic research and artistic professional activity has a long history and not only a western one. The occidental musical organization and perception has been residing in a process that places emphasis in symbolic abstraction through notes, intervals, scales and the very idea of notation (Campesato, 2007). Experimental practices regarding the nature of sound, acoustics, phonographic techniques and the act of listening as well as the functioning of human ear were amongst the many activities in this expanded field.

In a way, what started showing up as works of sound art since the 1970’s can be understood as the incarnation of such enterprise. In this case, not only the intersections between music and sound studies and all the issues around the physicality of it, but also the hybridizations within visual arts, installation, performance, cinema, computer science, gaming, amongst others. The strong emphasis on the element of sound is what defines sound art as a conceptual umbrella that encompasses works of a myriad of artistic languages in contemporary art circuits worldwide.

By sound art we understand a reunion of artistic manifestations that are in the frontier between Music and other arts, in which the sound is a material of reference inside an expanded concept of composition, generating a process of hybridization between sound, image, space and time (Campesato, 2007:63).

Amid the experiments known as the first ones within the realms of sound and/or noise rather than music as a established body of knowledge, are the ones implemented within the Italian futuristic movement by Luigi Russolo. Painter, composer, designer and constructor of early experimental musical instruments, in his 1913 manifesto, *L'Arte dei Rumori* (translated as “The art of noises”)
brings theoretical insights and an array of types of noises and classifications. In this process, what is considered to be noise along with diverse sounds from materials or nature are recorded, manipulated, edited and structured. The solid universe of established music has been modified by the introduction of noise, in an inclusive distorted twist.

A deeper problematization of the relations between music and sound as well as the nature of music and its materiality will be further addressed by Pierre Schaeffer and the musique concrète movement around 1950 in Paris. Being able to work in a studio with electronic equipments and controlled environment Schaeffer worked for many years in the direction of silencing the referentiality of sound (its context) and concentrating in the phenomenon of the sound. The concreteness of sound contrasts with the abstraction of the music (Campesato, 2007).

Silence is in itself material of a lot of reflections and derivations in contemporary art. The understanding of silence in music is also very ancient. In a very special way though, silence was exposed by Cage as constituent of our processes of enlisting types of sounds and the determinations that develop from that statement. The piece 4’ 33” from 1952 consists of three movements (a very conventional western musical structure) and the notation for each movement says ‘Tacet’. And by this instruction the performer is supposed to be silent. The lid of the piano is closed and yet there is still sound, from the environment and human bodies surrounding and presencing the experience. Sound is heard, but it is out of the control of the performer or the composer. The audience may be the composer. The audience may also be the performer. The performer, David Tudor, was audience.

Cage made diverse investigations into technological devices applied to sound and also explored in innovative ways traditional musical instruments. In his prepared piano pieces, sound is altered by objects placed between or on its strings or hammers. The indetermination places an important role in composition as well as performance. Associated with the first happenings, Cage was always choosing interdisciplinary paths and inaugurated a lot of what later became habitual in the creative process of contemporary art in general.

Hybridism and Interdisciplinarity

Any discussion of Visual Music, however, must remain "inter-disciplinary" (Moritz, 1986:25).

Sound art exists somewhere between music and the visual arts. It is a term for a diverse set of art practices which utilize sound and listening as the subject matter and material. It broadens some of the limits of music. It presents its proposal as a process rather than a focus on the specified result.
The history of sound art has many strands and threads and they don’t join together neatly at one convenient source like the branches of a tree. Tradition plays an important role here. Some sound artists feel an affinity with traditions firmly rooted in music, others associate themselves with the fine arts, with sculpture, installation, performance art and conceptual art. Some are connected with the spoken word, with poetry, text and the voice (Worby, 2006:3).

Among the wide variety of forms that might be grouped within the category of sound art there are: kinetic sounding sculpture, automatons, experimental radio, sound installations (often site-specific), guided sound-walks, instrument *luthieria*, graphic scores, sound poetry, acoustic ecology, phonography, *plunderphonics*, verbal notation, and even works in which sound is implied rather than explicit.

**Soundscape, Sound Installations, Soundsculptures**

The notion of soundscape was forged within studies of acoustic ecology (Schafer, 1968). Soundscape are the sonic configurations that circumscribe an environment. It carries all the manifestations of sound, their combination and the layers that overlap in synchronicity. It refers to both the natural acoustic environment, animal and organic sounds and weather as well as the sounds of urban public spaces, human conversation, musical compositions, machines and gadgets functioning, etc. The whole audible spectrum is taken into consideration and the social relations and health implications of these surroundings are concerns of this ‘earcology’.

The term soundscape can also refer to an audio recording or performance of sounds that create the sensation of experiencing a particular acoustic environment, in an immersive setting. The emphasis resides in the space and being occupied by it. Not only contemplating the work of art, but diving into it, and coming out again. Soundscape-like works relate directly to installation art and the sound installations and tone installations.

An installation can be gallery based, digital based, electronic based, web-based. Installation art often envelops the audience in the space of the work. The person enters a controlled environment featuring all kinds of material, objects, imagery, light and sound. In a piece of installation art the whole situation in its totality is proposed as being the work of art. Kurt Schwitters -- known as being one of the first inaugurators of the concept of installation -- created the *Merzbau* which was a project of working on the interior of rooms and buildings, accumulating angles, circumscribing areas, arranging the space not in a decorative way.
A sound installation is usually an intermedia, time based art form that includes sound, noise and silence elements. There is the use of interactive technologies, computers, sensors, mechanical and kinetic devices. The immersion needs to happen in order for the work to happen, but how long will it take and when is time to leave are instances suggested but not determined by the artist/composer. There is a lot of agency from the side of the audience. Another important characteristic of sound installations is that they are usually conceived for a specific site, the whole planning of the piece will take into consideration the elements and materials related to the very setting chosen. Sometimes the installation can be placed in another setting as well.

An interesting example of a sound art in audio that posits fundamental questions around the space is Alvin Lucier’s work *I Am Sitting in a Room* from 1969, in which the artist records a text, narrated by himself and then plays the recording back into the room, re-recording it. The new recording is then played back and re-recorded, and this process is repeated many times. Since all rooms have a characteristic, the effect is that certain frequencies are gradually emphasized as they resonate in the room, until eventually the text is unintelligible, mixed with the pure resonant harmonies and tones of the room itself. The text reads “I am sitting in a room, different from the one you are in now. I am recording the sound of my speaking voice…” and the instructions contained within the piece suggests that the audience tries the same experience in different rooms as a way of putting the work into circulation.
La Monte Young is a composer and sound artist that works within the compounds of the immersive propositions of installation practices as well. Very influenced by minimalism in music and interested in musicology and oriental musical tradition, he developed pieces emphasizing the use of sustained or repeated sounds, notes, or tone clusters (also known as drones). His works are typically characterized by lengthy pieces making use of high volume with relatively slight harmonic variations. The influence of Cage’s ideas is felt by the use of principles of indeterminacy in his compositions and also by incorporating non-traditional sounds.

The *Dream House 78’17’*, recorded in 1974, is a project that La Monte Young, Marian Zazeela and the *Theater of Eternal Music* (musicians and performers) started in 1963 and developed for years. As a twenty four hour constant musical endeavor, the project sustained itself, through time. Not silence, a shift of perception into what is habitual sound and what is not. The continuous electronic sound environment emerges before the audience enters the room and finishes only after the audience is out of it. This emphasizes the idea of an atmospherical experience, absorbent and transcendent. It is still today a light and sound installation, with speakers reproducing the material, and can be visited in New York, USA.

![Fig 2: ‘Dream House’ La Monte Young and Marian Zazeela, 1993](image.jpg)

In sound installations or tone installations, as the ones proposed by La Monte Young, the relation of the work with time of fruition is, in itself, a propositional feature of the work. The possibility to stay a longer time due to curiosity over the development of the sound is a temporal factor that allows the audience the time to explore the space thoroughly being then able to interact with the disposition of the different sounds in space at a personal pace. The association with a
phenomenological approach to the experience of art, involving the whole body, is direct. This aims a philosophical displacement of usual assumptions about basic elements of the environment and life itself, not only sound.

In a slightly different pathway from the sound installations, the soundsculptures are usually devices that produce some kind of sound with or without interactivity. It can be situated in the frontier between musical instruments, art objects and machinery. Usually transportable, soundsculptures place the emphasis on questions around the act of producing sound, materials and means by which they can be reproduced and manipulated.

![Fig 3: The Crystal Baschet, Bernard and Francoise Baschet, 1952.](image)

**Sound and Image**

In a certain way it is possible to find in the theories of Pythagoras and Aristotle, then in modern science literature regarding the correspondences of the color spectrum and sound waves, some antecedents for the visual music enterprise. The mere attempt of approaching the physics of nature in a more aesthetical way can be accounted for the mindset that will generate experiments of all sorts in the use of musical structures in visual imagery throughout history.

In a more factual way, “visual music” refers to methods or devices which can translate sounds or music into a related visual presentation. The original definition of the term “visual music”, as coined by Roger Fry in 1912, was applied to describe the work of Picasso, in an attempt to translate the
encounters between music and painting (Spalding, 1980). The color organ\textsuperscript{49} tradition for instance, first started with mechanical and electronic versions and then incorporated computer versions since the end of the 19th century. Alexander Wallace Rimington, Bainbridge Bishop, Thomas Wilfred and Charles Dockum are names associated with the group of artists who played, composed and fabricated color organs.

![Color organ](image)

**Fig 4:** Mary Hallock-Grenewalt playing a color organ (*Sarabet*) invented by her (circa 1920).

From “visualized music” to “image sonification” works known as visual music are ones in which both sound and image may be presented live, fixed, or as parts of intermedia related systems. By means of a mechanical instrument, an artist’s interpretation, or a computer.

The more classical examples of visual music include works close to animation and abstract cinema. Some films include hand-painting and scratching and a wide variety of known and unknown techniques. Important avant-garde contributions date from the 1920’s and 1930’s, including the California School of Color Music and the San Francisco filmmakers. Also a group affiliated with The Museum of Non-Objective Painting in New York City in the 1940’s; the 1950’s and 1960s light shows; computer graphics first attempts in early 1960’s and video synthesis works in the 1970’s (Gaudenzi, 2008).

\textsuperscript{49} Machines constructed to project colored light in rhythmic structures, often used as a means to visualize accompanying music.
Cinema for the ears and the *Plunderphonics*

The cinema for the ears of Walther Ruttmann and the ear film are derivative works in which the audio is suggesting narratives and inviting the listener to join in with the construction of their (individual) correspondent images. Contemporary artists such as Miranda July also can be situated in this artistic space that resonates the experience of the literature (the audio books), the radio, the thriller, repositioning the meaning of the act of listening and of engaging.

Alongside the sampling culture and the possibilities generated by the computer based, digitalized home studios, the focus is in manipulating material and editing existing data. Authorship and Copyright also are aspects of the questions that arise from this experimentations, in as much as “a sampler, in essence a recording, transforming instrument, is simultaneously a documenting device and a creative device, in effect reducing a distinction manifested by copyright” (Oswald, 1985:1).

Utilizing conceptual and methodological apputernances cognate with collage art, the procedure is to deal with sound in a plastic, pictorical way. Separating pieces, serializing them, adding and juxtaposing chunks of sound, transforming the material. This whole ritual, already explored with materials like paper, tissue or canvas could also be used with photography, video and audio footage. The “distinction between sound producers and sound reproducers is easily blurred, and has been a conceivable area of musical pursuit at least since John Cage's use of radios in the Forties” (Oswald, 1985:3).
*Plunderphonics* is the name coined by Oswald to describe kinds of sound works that create music using other people’s music. Without adding any new material, the result piece may resemble something already heard, but consists of a whole fresh composition. The idea is to work with “found sounds” just as visual artists have been working with “found objects” since Duchamp’s ready-mades. In 1989 Oswald released the album *Plunderphonics* with twenty-five tracks. It reworked material such as The Beatles, Ludwig van Beethoven’s *Symphony No. 7*, Michael Jackson (whose song "Bad" became "Dab") and others.

As a listener my own preference is the option to experiment. My listening system has a mixer instead of a receiver, an infinitely variable speed turntable, filters, reverse capability, and a pair of ears (Oswald, 1985:4).

![Plunderphonics album cover](image)

**Final Considerations**  
Whenever a subject suddenly achieves a level of great attention focused upon it, its definitions undergo a transformation and expansion. The concept of the expanded field helps the understanding of the continuously growing space of new articulations that provide different associations and meanings in art today.
Revising its institutionalization, art has been interdisciplinary for a while now. It has expanded its fields and opened itself into broader arenas. Art today, different from the avant-garde or the tradition, doesn’t put itself as the next step in the evolution sequence. Poetically, it is interested in accessing epochs, locations and contexts in a porous way, actualizing its diversity.

The expanded field of sound and image configure an open and broad path of experimentation and study that embeds itself in the interdisciplinarity of different fields of knowledge. This is an introductory research that aims to start a sparkle, intellectually and esthetically.

List of Images
Fig 1: Schwitter, Merzbau (started circa 1923). (source: https://schwitters57.files.wordpress.com/2010/03/99.jpg)

Fig 2: ‘Dream House’ La Monte Young and Marian Zazeela, 1993. (source: http://www.melafoundation.org/)

Fig 3: The Crystal Baschet, Bernard and Francoise Baschet, 1952 (source: http://upload.wikimedia.org/wikipedia/commons/e/e7/The_cristal_baschet.jpg)

Fig 4: Mary Hallock-Greenewalt playing a color organ (Sarabet) invented by her (circa 1920). (source: http://gened.temple.edu/happenings/files/2011/01/20110123_inq_cu1history23-a.jpg)

Fig 5: Norman McLaren “Dots”, 1948. (source: http://i.ytimg.com/vi/l0gFTFbRECI/hqdefault.jpg)

Fig 6: Oswald, John, 69 Plunderphincs 96 Box Set, 1969-1996. (source: http://paulcarr.org/2012/04/09/plunderphonics-mashups-and-primary-meaning/)

Bibliography


ARTISTIC WORKS
**Alejandro Brianza – Mikrokosmica**

Many events happen and we do not give them importance. Miniature worlds escape our sight (and all senses) daily. Mikrokosmika try to evoke the feeling of attending one of these miniature universes and casual behaviors that offer their habitants in their fast-paced lives. Imagine... How interesting it would be to listen through a microscope?

**Alejandro Casales Navarrete - Adsem Varien**

In this work, I aim to analyze and create from different java script situations, trying to integrate in the same research video frame, the “Adsem Varien.” The musical interaction appears as a sound composition that becomes a new experience with the java scripts. At the least “Adsem Varien” is a java script video, where dots and lines are deconstructed in different applications. The visual work is the outcome from a set of possibilities that can be formed with different qualities of points and lines.

**Alexander Martinz - 4 Woman**

Foley is the reproduction of sound effects that are added to film, video and other media in post production to enhance audio quality. These reproduced sounds can be anything from the swishing of clothing and footsteps to squeaky doors and breaking glass. The best foley art is so well integrated into a film that it goes unnoticed by the audience. In 4 women, four distinct characters perform four sounds that are needed to create one foley sound. The original process of sound production is therefor reversed. Rather than sound being made for a picture, sound leads to a picture.

**Alfonso Pretelt – Euridice**

The ideofonía felt to be understood as the sound event of the psyche is the beginning of Eurydice and Orpheus; entities underlying the metaphysical language that unfolds in this audiovisual piece. euridice uses sound as a medium to encode the fact and fiction of staging flowing hostel with a mercurial metal resonance and cymatics frequency enveloping the entire soundtrack, the same image involved establishing links between the organic and the digital.
Antonio D’Amato - *Opus III*

Maximize the transmission of emotions through a synesthetic correlation of a silent animated abstract film and an electronic music piece composed expressly for it.

**Antonio Mazzotti - Wall of Breath**

The model which I have designed investigates the deep connection between multimedia (sound/video) and emotional meaning. This bond is a fundamental part of the composer’s research. Models can produce highly complex musical objects. However, only the objects selected by the composer will constitute the new language used for expressing himself. Models are meaningless without the composer’s knowledge. Inspired by the psychoanalytical theories, the audio is generated from the elaboration of the voice. The videos deal with the audio because it has been generated using the same technique. The attention to the sonic details and the presence of a musical deep structure help the listener to understand the meaning of the work: sometimes a natural thing, almost primitive, may require some complexity to be expressed in the better way.

**Dave Payling - Space/Movement Sound**

Thomas Wilfred’s lumia components of form, colour and motion are used to influence the building blocks of this audio-visual composition. Sound analogies are used and textured sonic layers accompany evolving colour spaces while dynamic gestural sounds are paired naturally with visual form and motion.

**Dave Payling – Diffraction**

The phenomena of diffraction and refraction were used to influence the development and interaction of sound and visual materials. A method of audio refraction is used to filter broadband noise into harmonic tones. Tones are also combined to create noisy drones. The sonic narrative works in conjunction with visual metaphors of light refraction, diffraction and transformation.
Felipe Ramirez-Rodriguez & Santiago Echeverry – *Orishas*

*Orishas* is an experimental mixed-media piece involving surround sound, film and animation. The piece may work as a stand-alone video + audio, or may include live performers (musicians and dancers). The video, by visual artist Santiago Echeverry, was created by a custom code in Processing using a Kinect sensor and a webcam to transform the images of a masterfully choreographed dance, by Susannah LeMarquand, into a virtual three dimensional mathematical representation. 28,000 images are then imported into a video editing software and treated as a still frame animation. The soundtrack, by composer Felipe Ramírez-Rodríguez, includes original music involving afro-Cuban rhythms, multiples highly processed audio samples of actual Santeria ceremonies recorded by the composer in Havana, Cuba, as well as processed versions of known Santeria tunes and live musicians when possible. *Orishas* was created in homage to the communion between the worlds of the visible and the invisible, as epitomized in the Santeria ritual. This occurs, according to tradition, when a deity – Orisha - manifests himself/herself in human form through the body of a Santero, after an intense and ecstatic ceremony involving drumming, dancing and chanting. This mystical experience is symbolized during the piece through a masterfully designed interaction between complex sounds and magical-like moving images.

**Fernando Falci de Souza - Contrapontos 3, 2, 8, 9**

Using simple visual forms and short particles of sound, this work of visual music presents a possible micro-time counterpoint that takes place between the modalities of sound and image.

**Francesc Marti Perez - Speech 1**

*Speech 1* is an experimental audiovisual piece created from a clip from an Edward Kennedy TV interview of the year 1974. This piece would be a reflection on the action of communicating, highlighting his limitations, and can be labelled as “text-sound-art”, or “text-sound-composition” in an audio-visual framework. Technically, in this piece, the author has been experimenting how granular sound synthesis techniques, in particular synchronous granular synthesis, can be used for audiovisual creative works. All the piece sounds and images come from that clip, in other words, no other sound samples or images have been used to create the final result.
Ivan Penov - *Entropy Swing*

My videomusic works share a formal and material coherence in their temporal dimension where the images undertake a musical organization and the sounds obtain a gestural and theatrical role. By doing this, the visual material leaks its narrative identity and in the audiovisual unity it became an object ready to be explored. The audiovisual material acquires a spatial dimension by a hypnotic and non-temporal observation across a various transformational states.

Jean Detheux - *Evolution of Song_Y*

Evolution of Song_Y is the latest movie done in collaboration with composer Wilfried Jentzsch. The material sound is the old Chinese song Yangguan played by the Chinese lute. The full-ranged spectrum of this sound has been processed by “Fusion”. The most important functions are filter, delay, glissando and mixing (dry/wet). With “Evolution” has been realized transitions from harmonique to inharmonique, or inverse, with spectral granulation.

Jean Detheux - *The Visible Resonance of Bookends*

Here’s composer Mikel Kuehn’s description of his music: “The Secret World of Bookends (2005) is an electroacoustic fantasy based entirely on recorded sounds made by two generic metal bookends. I found the inexpensive bookends in the basement of my new house and was intrigued by the sound that they made when I accidentally dropped one. The resulting piece not only explores their sonic attributes but also the boundless imaginary world that exists in the myriad of thoughts and information between a functioning set of bookends. The sounds that the bookends make are gradually exposed and transformed over the course of the work. Most of the sounds in the piece were produced by striking, bowing, or grating the metal bookends.” I created the images by trying to find as simple a starting point as Mikel had when composing the music, what he explored in/with what he had just discovered “by accident.” My own “simple” start was the first video I shot with a new iPhone, capturing a short walk from my place to the corner-store (lasting 31 seconds), and then squeezing out of those 31 seconds all that I could, in resonance with Mikel’s music.
Jean Piché – *Horizons*

*Horizons* is a visual drone piece, unfolding very slowly. *Horizons* is an audiovisual origami obtained by folding a flat plane into a complex object that very slowly reveals itself as a polymorphous sculpture. Both sonic and visual materials are generated with recursive feedback processes. The suspended pace of the work suggests a meditative aesthetic but is really a side effect of these methods. Whispering voices accentuate the sensation of an enclosed yet distant environment.

João Pedro Oliveira - *Et Ignis Involvens*

This piece is inspired on the first vision of the prophet Ezechiel (Ezechiel 1:4): “et vidi et ecce ventus turbinis veniebat ab aquilone et nubes magna et ignis involvens et splendor in circuitu eius et de medio eius quasi species electri id est de medio ignis”. “And I looked, and behold, a whirlwind came out of the north, a great cloud, and a fire infolding itself; and a brightness was about it, and out of the midst thereof as the colour of amber, out of the midst of the fire”.

Joseph Hyde - *Cloud Chamber*

*Cloud Chamber* is an audiovisual composition made using the danceroom Spectroscopy software - a physics simulation based on the latest mixed quantum-classical model of our microscopic world. It is a successful arts/science project which provides an immersive audiovisual environment in which people gain an instinctive understanding of the behaviour of matter and energy at a subatomic level by interaction with the simulation.

Josh Simmons - *Breach of the primary pressure boundary results in burn everything/kill.*

3 digitally animated shorts on nuclear themes.

Jullian Hoff - *Cameos of Light*

*Cameos of Lights* is a tribute to the work of the Canadian filmmaker Norman McLaren and his visual music. I operate sound-image associations: association of grain, shape, color, movement, space, rhythm and intensity. Begone Dull Care, the original work from Normal McLaren and Evelyn
Lambert that was my source of inspiration for Cameos of Lights offer a rare vivacity but also have some ‘minimalist’ moments of a deep poetry. These two states guided my exploration.

**Marco Ciciliani – Via**

“Via” is an audiovisual work for live electronics and live video by Marko Ciciliani. It is characterized by a tight connection between the sonic and the visual media. Two synthesis methods are primarily used, the first one being scan synthesis, which translates the pixel information from the screen into waveforms that can further be manipulated. This is graphically displayed by a 3D “wheel” that can be rotated by the performer and thereby causes interpolations between five different waveforms that have been gained by the pixel scanning. The second synthesis technique is pattern-based synchronous grain synthesis, which is suitable to realize rhythmic patters when used at slow speeds, but which can also be accelerated, turning the rhythmic pattern into pitch information. Changes in the rhythmic organization of the pattern then result into timbral differences. The short impulses that are used by the grain synthesis are visually represented by two crossing lines. At high speeds these lines form complex interference patterns – something which in the Vimeo version of the video has unfortunately largely been lost, due to the compression of the film. The basic material of the film comes from video recordings of road underpasses, viaducts and interstates in New Zealand and California.

**Myrian Boucher – Cités**

Material to digital cities/ the world is reversed
inhabited space dies and reborn/ ruin or dust/ no matter
trace has resonance in us/ a noise that lasts

**Pablo Perez Zarate - Pantera Del Espacio**

As part of my research into Expanded Cinema, Visual Music and Globalization I composed this piece as a response to the Digital Cumbia movement that is taking place in the Americas. In Pantera del Espacio I am using experimental sound design techniques to create my own version of Digital Cumbia, creating a world were the traditional roots of cumbia meet a digitized world in outer space. The visual music created to express the music was sketched out from the images that came into my
mind when I listened to the music and focused on individual instruments or sounds. These sketches were then turned into After Effects animations and put together in Adobe Premier using an organizational system I created by which bars in music equal seconds in a film editing timeline. The overall effect is intended to precise, as individual animations relate to some of the sounds, yet it is be loose enough for the imagination to play with the music’s narrative. This video was presented as part of a multimedia installation projected onto the façade of the Hamilton House building in Stoke Croft, Bristol, UK in May 2014 as part of the first Art Weeknder Festival.

Roberto Musanti - Rotational Chaos

“Rotational chaos” is an audiovisual work that explores the relationship between images and sounds. Although the composition is abstract, because it is based primarily on the relationship between the forms, and between them and the sounds, the assembly of the material has the effect of a kind of narrative that we can define Geo/Math fiction.

Roberto Zanata – Gypsum

We should not write “about” Art, but “with” Art (and with art in general), as Jankélévich states during an interview . The phrase is deliberately paradoxical, but to be read with the utmost seriousness. What it means to “say” is that the attitude which makes art an “object” to write about, is able to arise only within art itself. The pace of this writing should be unsystematic and less inclined to follow the conventional canons of classical essay writing. Art is not made for revealing the meaning; paradoxically once again, what art can do at most, is to show the meaning by removing it and by making it fugacious in the act of revealing it. At best, we can catch a glimpse of it as a reflex (“to say it over and over again, relentlessly and inexhaustibly” ), without leading it to “say” substantial, as we are often persuaded to believe in Western culture context. Abstract Audio Video enterely made with open source software Supercollider. The code of the sketch takes in consideration space and sound at the same level of importance.
**Terry Trickett - Abîme Des Oiseaux**

Abîme des oiseaux is the third movement of Olivier Messiaen’s Quatuor pour la fin du Temps (Quartet for the End of Time) composed in extraordinary circumstances, in 1940-41, when Messaien was a prisoner of war. It was influenced by the composer’s daily ritual of listening to the chorus of waking birds; Messaien had long regarded the clarinet as the ideal instrument for imitating birdsong which explains why Abîme des oiseaux is written for solo clarinet. Creating visual images for Abîme des oiseaux poses a challenge but I have been guided by two key facts. First, Messaien saw his music in vivid colours; he believed in the concept of sound-colour which enabled him to visualise the ‘colours’ of other composers, particularly Debussy and even Mozart. Secondly, Messaien always said he was born a believer and he retained his religious conviction, as a Catholic, throughout his life. This helps to explain why, for him, Chartres Cathedral became a place of pilgrimage and, in particular, the shimmering textures of its stained glass windows and use of ‘Chartres blue’ remained a life-long inspiration. It must be remembered that Messaien revered not only nature and the singing of birds (in his opinion, the world’s greatest musicians) but also the radiance of colour.

**Terry Trickett - Three Arabesques**

As an architect, I have a lifelong fascination with geometry – not only Euclidian Geometry but, also, Islamic Geometry. It is no surprise, therefore, that geometry underpins Three Arabesques: a digital celebration of Islamic architectural ornament. In the past, Islam was far ahead of the West in producing complex art forms based on the dynamic concept of trigonometry. Now the advent of coding enables artists in the West to perform similar feats of mathematical ingenuity.

**Yan Breuleux – Tempêtes**

The audio-visual composition Tempêtes is inspired by the late work of painter Joseph Mallord William Turner. It is presented as a journey through a series of chaotic panoramas undergoing continuous transformation. Featuring a sequence of changing scenes, Tempêtes blends visual synthesis of particle clouds with an electroacoustic composition created in collaboration with cellist Soizic Lebrat.
COMPUTER ART EXHIBITION
Anelise Witt e Jóse Pedro de Santana Neto
Encantador de Serpentes

Arthecmedia (Bilbao)
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Daniela Kutschat Hanns, Leandro Velloso, Maurício Galdieri e André Damião
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Analogias Sonoras

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