A glow on Pythagoras' curtain. A composer's perspective on Electroacoustic music with video[1].

Dr. Diego Garro
Keele University
Department of Music
Keele
Staffordshire ST5 5BG
United Kingdom

Tel. +44 (0)1782 583298
d.garro@mus.keele.ac.uk

Abstract

Composers of Electroacoustic Music worldwide seem to be drawn almost instinctively to a new, exciting media which combines electroacoustic sounds with the moving image, captured with digital cameras, processed with off-the-shelf commercial software or specialized applications. The reason partially lies on a technological convergence: in the solitary reclusion of the music studio the enabling technology for digital audio-video experimentation reside in the same workstations used for modern computer music endeavors. It is an opportunity that has been staring us in the face for a few years. With the aesthetic and technological convergence came also the realization that the combination of the two media yields tremendous potential for a momentous development of the Electroacoustic idiom. Depending on the compositional strategies, digital artists can explore the relationships between the phenomenology of the *objet sonore* and that of the moving image, towards the definition of what we could may call *objet audiovisuelle*.

Introduction: convergences

> "What makes the electronic arts of sound and light so attractive is the feeling that they present a virtually infinite field of forms and structures to be explored. Every combination of frequency, amplitude, waveshape, and their individual and combined envelopes

[1] This paper was originally presented at the Electroacoustic Music Studies Conference - Sound in multimedia contexts, Montréal, 2005. This document (2011) contains some minor amendments and corrections. The examples quoted in the text are available on the various website. The reader is encouraged to use them for reference while reading this text.

> result in a different form. Composition in the electronic arts will be with us for a long time to come, as long as electricity remains an essential human tool." (Pellegrino, 1983, p.2111)

Modern desktop computers are powerful enough to capture and/or generate sounds and moving images, manipulate them, and integrate them into an digitised audio-visual finished product. Artists and their audiences face issues related to the idiom that this new technology makes possible: how will composers utilize these converging technologies for artistic expression? How will audiences interpret the new outcomes? What influence will cinema, TV, videogames, and, last but not least, music in whatever incarnation, have on creators' choices and audiences' responses? How will artists coalesce 'electronic images' and 'electronic sounds'?

Composers of Electroacoustic music seem to be drawn almost instinctively to this new, exciting combined media. We are witnessing a technological convergence: the enabling technologies for digital audio-video experimentations reside in the same workstations used for modern computer-music endeavors. It is an opportunity that composers had for years, and finally are taking advantage of. From the aesthetic viewpoint, audio-visual composition represents a predictable corollary for some sonic artists who normally approach sound-based composition in a 'visual' manner, establishing explicit and/or implicit clues to an imagined visual dimension of the time-varying audible spectra.

Modern heirs of *musique concrète*, accustomed to compositional techniques that handle directly a physical incarnation of sound material, benefit from this stimulating convergence i.e. the availability of powerful tools to compose organically with both digitized sounds and digitized images, and the desire to engage with the audio-visual media. In our case, as a matter of course, we may be particularly attracted by the opportunity to experiment with the technical and the aesthetic implications that arise from an approach to audio-visual composition borrowed from the tradition and the contemporary practices of the sonic arts.

Phenomenology of sound vs. phenomenology of moving image

Some electroacoustic composers will be inclined to extend to the audio-visual domain the typical approaches they adopt when composing with sounds. Attention to spectral properties, discourse based on the articulation of morphological attributes, associative power of sonic manifestation to a real or imagined sound source are compositional concerns that can be transported into the audio-visual media. Drawing largely from Smalley's terminology (Smalley, 1986, pp.65-80 and 89-92) the phenomenology of a discipline based on shaping time varying sound spectra

can be described in terms of spectral typologies, basic morphological types and their combinations, spatial properties, and their respective categories of behavioural motion in time. The electroacoustic idiom also strives on the use of associations with the real world, their anecdotal connotations, the narratives involved, and their symbolic or metaphorical power.

Similarly, we could describe an art of audio-visual structures in which *visual objects* also can be described using similar semantic categories. For the sake of compositional considerations, a phenomenology may for example comprise color, shapes or 'forms', surface texture, granularity of the geometries, spatial attributes and perhaps others. The attention to the overall sound texture and virtual acoustic stage within the audio mix can be extended to the audio-visual domain, incorporating cinematic issues such as mise-en-scene, cinematography, or photography, and perspective. Color attributes can be described in terms of hue, saturation and value. Shapes will vary depending on their geometry, size and dimensions (mono, bi, tri). Surface texture, a rather elusive concept, would probably be related to descriptive analogies from the real world. The visual granularity would discern for example one or more separate objects, clusters, granular clouds, etc. The spatial description would in most cases involve perspective, position, and movement across the physical space, usually a projection screen, where the action takes place, with attributes such as location, trajectory, velocity and acceleration.

Like all visual arts, a creative discipline of computer generated audio-visual objects may also be concerned with its intended or perceived figurative aspect, with implications for the narratives brought to mind that are perhaps even stronger than those introduced by recognizable 'real' sounds in the Sonic Arts. Furthermore, as the attributes of both sound and visual change in time, idiomatic characteristics may emerge specifically from the practice of articulating the time-varying phenomenological attributes discussed above.

Audio–visual mapping

Mapping music to images represents a challenge that has occupied the research and the practice of many theorists and artists for centuries (Collopy, 1998-2001). The color versus pitch mappings, in which different hues correspond to the twelve semitones in a western scale, has served some purpose in the design of color organs, devices operated via a conventional piano keyboard used for visual music live performances at the end of the nineteenth century (Peacock, 1988, pp.397-400). These mapping techniques are grossly inadequate once the palette of sound and visual material at composers' disposal expands, thanks to modern electronic and digital capturing technology. More interesting is Whitney's experimental approach to compositions of visual morphologies resulting by permutations of geometrical

primitives according to procedures that relate to the techniques of twelve-note music (Whitney, 1960, pp.62-63). In fact, in this case we no longer have a deliberate correspondence between materials abstracted from their artistic context but, instead, a flexible methodology to integrate organically audio and video material according to contextualized rules.

The ever increasing power of modern computers and the sophistication of the software applications able to manipulate audio and visual data, do not necessarily provide any significant aesthetic breakthrough. What we call 'mapping' may, or may not, become a technically formalized exercise. The level of integration between audio and video gestures can span the whole range of a continuum, illustrated in Figure 1, whereby at one extreme we rely on purely interpretative clues, seeking a loose rendition of a sonic passage with visuals or vice-versa.

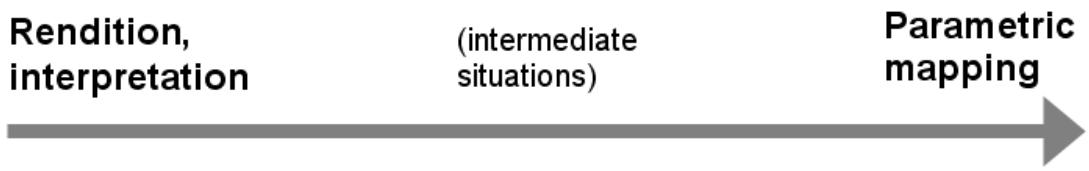

Figure 1. Continuum of audio vs. visual gestural association strategies

At the opposite extreme, audio and visual are combined together according to the mutual profiles of some phenomenological attributes, for example a certain pattern of change in the brightness of the images can be mapped, according to certain laws determined by the composer, into a corresponding pattern of spectral focus in the main sound accompanying those particular images. In intermediate situations the integration between sounds and visuals is designed using both loose interpretative considerations and some mapping of phenomenological attributes, albeit not in an obvious or substantial way.

The interpretative approach relies on intuitive considerations upon the psychological response to the combination of audio and visual stimuli. Examples of this approach are very common in film music composition. An illustration of similar techniques in audio-visual art can be found in Steve Bird's *Border Unrest* (2005); a bridge passage between 2:40 and 3:30 features abstract images with shifting curvilinear profiles, overlapped with still images of flowers, accompanied by a noise-based soundtrack featuring colored noise and isolated semi-pitched gestures. There is not a clear phenomenological mapping between audio and visual, a part from a vague commonality between the subdued moods suggested by the two. The gracefulness of the undulating shapes is reflected, purely on an intuitive basis, by the gentleness of the noises. The soundtrack features only two, only slightly, different spectral typologies and, similarly, the visuals feature very few hues and geometrical patterns.

Figure 2. Steve Bird – Border Unrest. Three frames from a bridge section.
© Steve Bird, used by permission

The same composer gives us a case in point of what I described as 'intermediate approach' to audio-visuals mapping which utilizes both interpretation and some recognizable associations between the attributes in the two media. In the exposition of Bird's *Café Concrète*, 0:45 – 1:25 (2005), the combination of a granular stream of sounds with the fuzzy shapes moving across the screen seems rather deliberate but there is a vague correlation between the blurry contours of the images and the 'tentative' amplitude envelope of the sound grains, as well as their hazy spectral detail, that form the stream.

Parametric mapping allows composers to establish explicit links between one or more attributes of the visuals and one or more attributes of the sounds. When such a close tie between the temporal trajectories of the parameters is established, sounds and visual behave in synergy: more than a spurious parametrical convergence we now have a fusion of the two media. We create, articulate and compose audio-visual objects as envisaged by Pellegrino when he observed that

> "The principle of synergy, i.e. that the whole is greater than the sum of its parts, is fundamental to the nature of complex interactive dynamic sound and light system and their resulting forms." (1983, pp.208)

For example, the second section in *Pointes Précaires* (Garro 2003) between 3:40 and 4:53, features streams of granular sounds in mid-high frequency range. These are tightly linked to clusters of white particles which density changes in symbiosis with the granularity of the sound itself. Often the pitch focus of the sonic streams moves up while the clusters also follow a trajectory from the bottom of the screen towards the top. Furthermore, the size of the constituent sonic grains changes according to the size of the shapes of the elements that form the colored clusters. Half way through this section metallic sound grains with longer exponential attack are paired with bigger glaring blue-brown morphing shapes: the viewer is tricked into believing that these audio visual 'crystals' amass into metallic sharp blades of sound and color.

The section between 5:30 and 6:30 features various events, each lasting a few seconds, which have been designed organically in both their visual and sonic

domains. They can be defined as audio-visual 'gestures', for the audio and the images possess energy profiles that can be associated with typical human motions/actions, for example throwing, pulling, blowing or indeed initiating a sonic event on a musical instrument or performing a brushstroke on a canvas. The amplitude envelope of the sounds, especially on the onsets of these events, is directly linked to the movements of the 3-D objects, illustrated in Figure 3, their appearance on the screen, and their rotations on one or more of their axis. As the three-dimensional geometries crumble into two-dimensional moving patterns of fragments, the sound also breaks, disintegrates into flapping granular streams and disappears along with their visible particles counterparts.

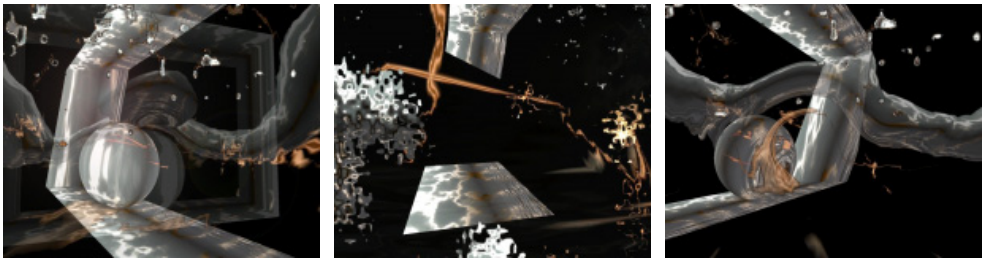

Figure 3. Diego Garro - Pointes Précaires. Still frames from audio-visual gestures.

Compositional limits of audio vs. video mapping

Parametric mapping may provide a system for associating sounds and visuals in an organic fashion. Some computer music composers may be particularly attracted by techniques, typically available in C-Sound, Supercollider or Max/MSP, whereby time-varying attributes of the material can be controlled by specific functions designed by the composer. However, parametric mapping on its own does not constitute a self sustaining methodology to define an audio-visual language, nor it provides a formal 'solfege' for audio-visual objects: there is more to composition than a literal mapping exercise. Composers will often resort to some degree of close link between audio and visual gestures but will want to retain a holistic approach to their work in the studio, trusting their instinct and their optical/aural response to the materials and, especially, their organization along the time axis in larger architectures. In fact, as in sonic art, the reason for the aesthetic success of an audio-visual work seems to escape any discernible tenet. For instance, in the introductory section of Miller's *Residue* (Miller 1999) a moving cubic shape, textured with morphing red vapors (see Figure 4), is associated with long, ringing inharmonic tones on top of which sharp reverberated sounds, resembling magnified water drops, occasionally appear.

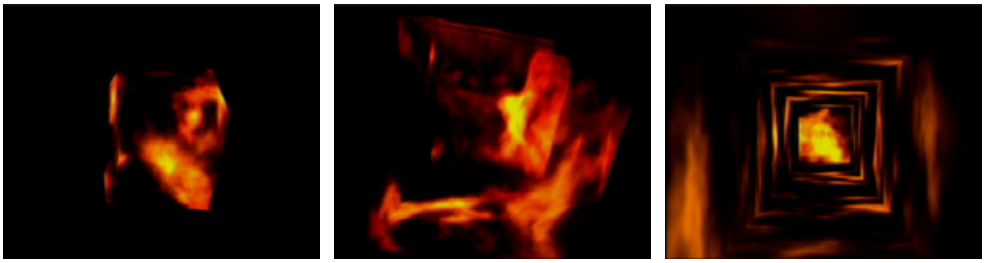

Figure 4. Dennis H. Miller. Residue. Cubic geometries at the onset of the work.
© Dennis H. Miller, used by permission

The association between the cube and the related sounds cannot be described in parametrical terms and in fact seems at first rather arbitrary. However, the viewer is quickly transported in an audiovisual discourse that is surprisingly coherent and aesthetically enchanting. It is clear that those images and those sounds 'work well' together although we are not able to explain why, certainly not in terms of parametric mapping. A closer analysis of this work, and others by the same author, reveals that it is indeed the articulation in time of the initial, deliberate, audio-visual association that makes the latter so convincing: we do not know why the red cube is paired with inharmonic drones at the very onset of *Residue* but, once that audio-visual statement is made, it is then time-articulated in such a compelling way that the sounds to images associations become almost immediately satisfactory and self explanatory even without any formal mapping.

None of the examples quoted in the previous paragraphs can be mathematically quantified in terms of mapping laws linking the visuals and the sounds. However, it is their qualitative evaluation within the artistic contexts established in the work that points to a discernible link between the two media. More often than not, works for computer generated audio and video achieve various degrees of integration between the two media, thanks to a complex interplay of many aspects mentioned so far. A formalized audio-video mapping would rarely explain the artistic intention of an audio-visual composer and would not necessarily provide a satisfactory creative framework either.

Audio-visual balance and redundancy

As well as the type of audio vs. visual association (see previous paragraph) composers will inevitably take decisions upon how far this integration should be pushed. Although parametric integration can provide strategies to develop one's gestural design style, especially at lower hierarchical level in a composition, it may also prove too deterministic and normative. Audiovisual redundancy may result

from an effort to relate tightly attributes of sound with attributes of images throughout a piece of work. Recorded or filmed materials, as well as computer-generated or computer-processed ones, are most probably very rich in spectral and morphological details. This makes a strict mapping exercise not only very difficult but also, compositionally speaking, superfluous in most cases.

Similarly, the choice of the materials can also be responsible for works that lack unity and consistency. This is certainly a pitfall for some electroacoustic music and represents a difficult challenge when we extend our compositional effort into the audiovisual domain. Audiences from most of the industrialized world are nowadays accustomed to an audiovisual language, rooted mainly in mainstream cinema and television broadcasting, in which the pace and the density of the stimuli are extremely high, and rarely articulated. Audiovisual composers can decide to align their style to audiences' stratified habits and expectations but, more likely, will want to challenge them and, instead, work towards a more balanced articulation of time, alternating areas of a work at higher density with moments of lower activity; a balancing act that may be problematic for creators who are not accustomed to work in the combined media. Composers, including electroacousticians, may have a clear sense of what 'allegro' and 'moderato' are, in terms of tempo and mood, but they may find difficult to translate these categories into their audio-visual equivalent, often underestimating the impact of the moving images in the viewer's experience of the attributes that affect the structural balance of a work involving video.

The bridge section of *Pointes Précaires*, between 4:40 and 5:30, for instance, introduces a sudden change of tempo in the soundtrack while the visuals, illustrated in Figure 5, become very sparse featuring just one small rippling worm-like object on the top-right corner of the screen.

Figure 5. Diego Garro - Pointes Précaires. Low visual activity in the bridge section.

Both sounds and visuals in this bridge section remind of materials featured in the first introductory section of the work and are sparsely assembled, in sharp contrast with the intensity of the section that precedes it. Not much seems to happen, although a closer look reveals subtle internal activity of the mid frequency washes of

chords in correspondence with the delicate rippling movements of the visual object which becomes gradually smoother as the bridge section slowly comes to an end.

The balance between low and high levels of activity may refer to macro-structural levels of a composition but may also dictate aspects of 'phrasing'. The audio-visual language of Cope and Howle's *Open Circuits* (Cope and Howle 2003) resembles the frantic montage of cinema hall film trailers or many TV commercials. However, it escapes clichéd associations interspersing moments of tens virtuosic mosaic with moments of sudden tranquility. Furthermore, the rapidly shaking camera filming technique, in combination with particular values for exposure and shutter speed, provides highly powerful visuals, illustrated in Figure 6. The video track features trails of lights from traffic and city neon signs. These are contrasted by slower abstract animations featuring computer generated swirling shapes. Therefore, moments of hyperactivity are morphologically linked to moments of repose.

Figure 6. Nick Cope and Tim Howle – Open Circuits. Still frames from initial section.
© Nick Cope and Tim Howle, used by permission

Compositional choices and idiomatic concerns

When they engage with the audio-visual medium, composers of electroacoustic music can benefit from their experience in the world of creative audio. Concern and familiarity with the spectro-morphological properties of the materials represent a fertile ground for an art involving digitally enhanced manipulation of moving images. Furthermore, their experience in articulating satisfactory musical structures can help them understand the creative and perceptual implications of any time-based expressive media, including the moving image. In fact, as Collopy observed with reference to the passage from painting to film (Collopy 2000, p.359), regardless of the physical embodiment of the materials used in a certain media, whether it is an audible signal or a visible one, the act of composing is a, perhaps ambitious, attempt

to articulate not just a particular medium and its constituent materials but, chiefly, the most elusive and immaterial element of all: *time*.

The addition of the visuals may generate several conundrums for music composers. They, and their audience, are both likely to have grown up in the age of film, television, videogames and Internet streaming multimedia. The immersion in this visual culture is inevitably suffocating, if nothing else due to the immense penetrating power of television and advertisement. Whether we realize it or not the baggage of millions of images we grew up with, the burden of thousands of, mainly visual, idioms we were exposed to, will come with us to the project studio and will sit next to us in front of the computerized workstation when we compose.

Poly-phony and 'Poly-orama'

Polyphony is used in electroacoustic music in a variety of contexts, for example overlapping multiple streams of granular material, orchestrating different 'parts' to different sounds and/or evoking multiple associations with real or imagined sound sources, often to create the illusion of a 'soundscape'. As polyphony ('many sounds' in Greek) will inevitably feature in the soundtrack of a video work we should investigate the existence and the nature of its visual equivalent, something we may call *poly-orama* (many images), borrowing again from the Greek vocabulary. The mapping between polyphony and polyorama can be a reductive one, whereby the viewer is presented with visuals that relate only to one layer of the polyphony or one sub-aggregate of layers.

The soundtrack of the first minute of Schindler and Maxwell's *Terra Incognita* (Schindler and Maxwell 2001) features an arrangement of sounds from acoustic instruments and vocal utterances. The musical material is chaotic, as it results from the compact overlap of various clusters of sounds having different density and duration. At first the visuals (see figure 7) feature bright lines flickering on the screen at a pace that seems to reflect the granularity of certain streams featured in the sound, focusing the viewer's attention on these rather than others.

Figure 7. Allan Schindler and Stephanie Maxwell - Terra Incognita. Still frames from the introductory section
© Allan Schindler and Stephanie Maxwell, used by permission

In doing so the balance of the musical polyphony can be dramatically altered, as a powerful visual clue is provided to the viewer as to what layer(s) of the polyphony carry more important information within the audio mix.

A different strategy for plyphony-polyorama may involve the use of split regions of the screen in which different layers of the polyphony are given a sonic counterpart. The section between 2:30 and 3:50 of Moore's *Resonant Images* (Moore, 2003) features a dense combination of granular sound streams while the screen, illustrated in Figure 8, is continuously split into thin rectangular sections, vertical and horizontal, inside which different 'stream' of visual activity seem to accompany the various ripples of the sonic texture. This correspondence is reinforced by the T and + shaped intersections between the video regions that appear to mirror the sonic junctures between the tightly interwoven sound streams.

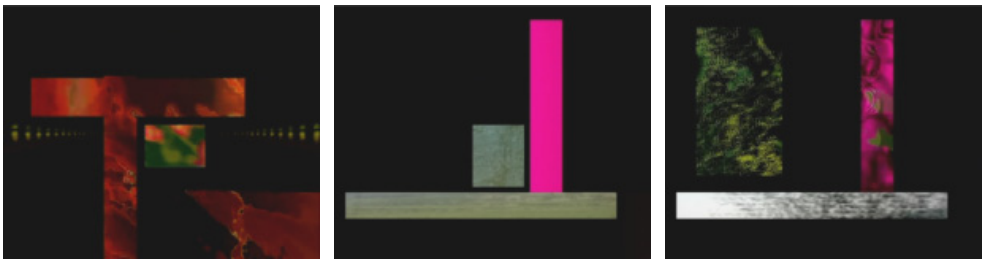

Figure 8. Adrian Moore, Resonant Image. Still frames showing split screens.
© Adrian Moore, used by permission

A purely geometrical division of the screen can also suggest a certain separation of the spatial location of the sounds in the acoustic space, and can reinforce an existing one. This is indeed a possible synergetic effect that may influence the polyphony-to-visual associations one is trying to establish. Moreover, partitioning the screen may focus the viewer's attention on the separation between sonic layers of the polyphony, again with consequences upon the musical balance. The simultaneous appearance of different visuals in different areas of a screen does not necessarily establish a perceptual parallel with a polyphonic passage. From the point of view of the stimulus and its perception, there is no equivalent of polyphony in the visual domain. For while we are able to discern the component layers of polyphony, as well as appreciate the resulting 'gestalt' of the mix, we do not see a 'mix' of different overlapped visual streams: polyorama, as a faithful optical equivalent of polyphony, does not exist.

Transparency is a video technique that enables composers to make some parts of an image partially transparent so a second image can be seen 'through' the first one.

Video transparency can be used to map polyphony and is indeed compositionally interesting, as it may engage the process of vision in a way that is similar to the aural decoding of polyphonies, especially those in which sound sources are recognisable. The viewer can 'see through' two, or more, overlapping image streams and decide to focus on one of them at any time or on the resulting blend. Nonetheless the focusing process may prove much more problematic than the equivalent perception and assessment of polyphony, especially if more than two video streams are involved, possibly due to the fact that polyphony, unless masking effects occur, does not impair the appreciation of its components, while transparency inevitably does.

Fading, cutting, dissolving - the audio-visual montage

Most music, whether it is performed live, or recorded on a fixed media or produced entirely in a project studio with electroacoustic techniques, does not feature abrupt cuts of the acoustic signal. This is certainly true for music projected in a real acoustic space. In fact, the mechanics of sound propagation prevent the sound wave from disappearing instantaneously, as multiple reflections, in the form of echo or reverberation, always provide a more or less gradual decay of the sound, a gradual release we came to regard as natural. The practice of sound mixing reflects the reality of acoustics, whereby fading and cross fading techniques are used to prevent straight cuts and to retain or replicate, in the audio mix, the same dissolving effects that characterize sounds in the real world. Straight cuts on audio-clips are easily implemented on hard-disk multi-track mixing applications but, for the aforementioned reasons, are generally avoided even by most experimental studio-composers with the exceptions, perhaps, of certain *glitch* or *electronica* productions.

On the other hand, straight cuts between video clips are part of the mainstream idiom of cinematic montage and are widely used in films, advertisement, documentaries, television and video-games not to mention the 'zapping' effect caused by the swift disappearance of one web page, when the next one is opened while browsing the Internet. Therefore, the same cutting technique produces acceptable, or at least expected, results in the video track but yields less suitable results in the audio track. This discrepancy may interfere with the compositional process, especially when one tries to establish links between the audio mix and the video montage.

One possible strategy to achieve a convincing sonic commentary of video straight cuts is applicable in cases when the cuts separate two shots of the same 'scene', real or abstract, from different camera positions or angles: that is to introduce an abrupt change in spatial location, or spatial focus, or ambience of the accompanying sounds. In this way, a change of visual perspective would correspond to a shift of perspective within the sound stage of the soundtrack. When straight cuts introduce visual objects

that are significantly different from those utilized thus far, the audio commentary may feature an additional sound, or sound textures, somehow related to the newly appeared visuals. Vice versa, the effect of sonic gestures may be reinforced by video material introduced with straight cuts or sharp cross fades.

In some circumstances electroacousticians may decide, for example, that audio-video montage methods that are common in cinema and television do not fit their style or indeed the audio-visual language of the particular work being developed. Burns' *Copper Island*, for example, contains no montage at all (Burns, 2003). The video material can be divided in no more than three long shots, approximately three minutes each, something that in film or television would probably be considered an anathema. In the context of this work such a limited use of video cutting is coherent with the emphasis on long sound textures, subtly and slowly morphing into one another. The extended uninterrupted animations, gradually mutating as illustrated in Figure 9, form a video track that reflects the artistic intent clearly expressed in the soundtrack.

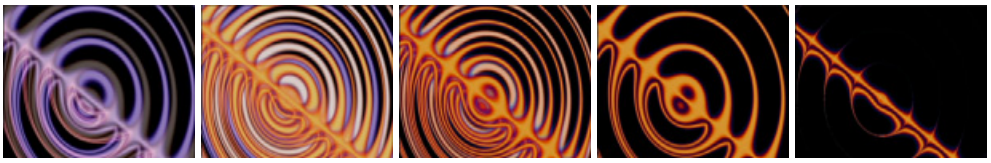

Figure 9. Kristine H. Burns, Copper Islands. Five still frames from extended sections featuring gradually morphing shapes. © Kristine H. Burns, used by permission

Video fades and cross-fades of various types, even highly sophisticate ones, are indeed achievable easily within modern computer-based video editing suites, yet the straight cut remains the most common montage technique used to move from one scene or shot to the next. Transition between video clips other than straight cuts may involve cross-dissolving or perspective and geometrical effects, such as zooms, band slides, iris, spins, wipes, stretches or flips. Furthermore, some may involve more invasive manipulation of the images, such us alteration of the color channel settings, luminance or texture. All transition effects listed above, however, should be regarded, from the compositional viewpoint, as visual aesthetic statements, rather than simply editing techniques. They inevitably interfere with the visual discourse because they are visual objects in their own right, with distinctive features and behaviours. For example, a repeated extravagant transition between video clips would inevitably become part of the content, and not merely a montage trick, raising issues of coherence with the context of the work as a whole. Similarly, the alternation between many different types of video transition effects would raise similar concerns

for the unity of the work. Therefore, aesthetic considerations and established practices seem to indicate that straight cuts and cross dissolves constitute the video montage techniques that less interfere with the compositional intentions otherwise expressed in the video track.

The soundtracks in 'split-edits' montage techniques feature unedited pieces of music while the video track, instead of comprising a single 'shot', contains the juxtaposition of various material divided into split video clips. The temporal placement and narrative content of the video are not necessarily related to the material featured in the musical soundtrack, a situation that is frequent in documentaries and popular music videos. Applied to audio-visual composition 'split-edits' implies a relatively free and instinctive approach to the montage, but can impair the audio-visual unity of the work and the integration between sounds and visuals into multi-media objects, assuming this is part of the artistic intention in a certain piece. An example of split-edits can be found in *Pointes Précaires* 'adagio' central section, between 6:30 and 10:20.

Video transparency and compositing as techniques for mixing video and tools for visual design

On a macroscopic level audio mixing is used to create one 'orchestrated' music track from the combination of 'parts', usually associated with the instruments that feature in the ensemble. However, modern computer-based multi-track audio mixing software allows a sample-level editing detail whereby amplitude levels, fades shapes and panning of the individual sound can be finely controlled and automated at microscopic level. Therefore, mixing can become an important tool for sound design, whereby two or more sonic components can be combined to form the final sound object. These components may be spectral repetitions-variations of the same initial sounds, for example coming from more or less diverse parameters settings of the sound processing or sound synthesis stage. In other circumstances, the components can relate to each other in morphological fashion, for instance a sound with a sharp attack and a dense steady state can be rapidly cross-faded with a sound featuring a dense steady state which evolves into a sparser and sparser decaying granular stream.

In the world of digital video the equivalent of mixing can perhaps be found in transparency and compositing techniques, by means of which two or more video film footage can be overlapped. Transparency makes all or part of an image totally or partially transparent so the one 'underneath' can be also seen. In chorma-key compositing, an object filmed against blue or green background can be

superimposed to a different video clip and will appear to be part of it, while the background will be keyed-out and become totally transparent. Modern software applications allow very sophisticated compositing modes (additive, subtractive, difference, multiply, etc.) which can yield highly seductive results in terms of contours and colour patterns.

Different visual objects can therefore be combined to form new ones in a way that resembles detailed audio multi-track mixing described above. In *Time & Tide* (2008) Steve Bird utilized transparency and compositing modes almost throughout the work, amalgamating two or three separate videos to create complex visual textures in which the single components are sometimes to some extent discernible and sometimes are lost in the resulting aggregate.

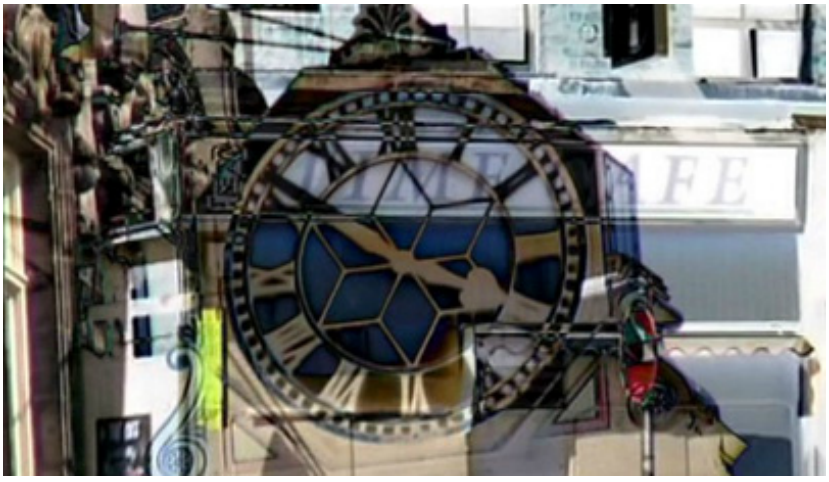

Figure 10. Steve Bird -Time & Tide. Still frame illustrating the use of transparency and compositing modes as tools for video design. © Steve Bird, used by permission

What can video do for Electroacoustic Music?

One of the pillars of electroacoustic music culture, and perhaps the most important of all, is the empowerment of the aural dimension of our sensory abilities. Practitioners and listeners share this fundamental credo and are committed to utilize advanced audio technology to push it further and further. Composers always strive to develop an increasingly rich and diversified vocabulary of sonic materials and to explore ways in which these can be used to articulate time and space. It is only natural that the introduction of the visual dimension into the electroacoustic idiom is regarded by some members of the community as an unwelcome intrusion into the uncontaminated world of invisible sound entities. Video, it can be said, distracts the attention of the viewer from the marvel of the sound world we may design into the

soundtrack: it breaks the musical magic. However genuine these concerns may be, we should never forget that 'Electroacoustic Music with Video' as it is often labeled in concert flyers and events listing, is a new form of expression that is rather distant from electroacoustic music as we know it, no matter how 'electroacoustically flavored' the soundtrack may be. The addition of the moving images does not simply complement the sounds: it brings about a wealth of new compositional challenges and shifts both the creator's and the viewer's experience to a position that is surely fascinating, yet quite removed from the one they occupy when they deal with sounds only. Audio-visual art, in the form developed by many electroacoustic composers, can perhaps draw a number of viewers, students and film practitioners closer to the world of electroacoustic music, with which it shares the fundamental philosophy of approach to the time-varying materials and their articulation into artistic aggregates. Nevertheless, we should not underestimate the important implications of adding a second media to an idiom which presupposes the primacy of one and one only.

Conclusions

In a moment of technological convergence between the audio and video digital technologies, and the creative platforms they support, electroacoustic music composers are in a privileged position to give an imaginative and original contribution to the body of work being created in this media. In doing so they will constantly define, and perhaps dispute, idiomatic relationships between audio-visual composition and the language of other technology-rooted forms of expression and communication, such as film, television, videogames and the world wide web. The technological challenges ahead should not focus exclusively on means for design, synthesis and manipulation of material, but hopefully also on ways to project them in real architectural spaces so that the concert ritual, still a pillar in electroacoustic culture, can be extended to audio-visual works. Multi-loudspeakers sound projection of acousmatic music can do marvels in articulating the sonic space around the listeners, creating invisible sculptures of sonorous entities, hence challenging the audience's perception of the physical space they occupy. Technologist and artist involved in new time-based digital media should perhaps dream of ways in which visuals also can occupy the three-dimensional space, and not a mere two-dimensional section of it on a projection screen.

Sonic Artists will draw from the wealth of creative treasures they accumulated as a result of their experimentations with, and reflection upon, working practices that manipulate *concrete* embodiments, analogue or numerical, of time varying audible spectra. Journeys across sound worlds that are real, or constructed, or synthetic or intriguingly ambiguous, have been narrated using novel musical languages. These

explorations have certainly been enabled by technology, but do not unwarrantedly celebrate it. Those who have traveled through these paths can now take an additional turn and explore with confidence the captivating potential of digital audio-visual composition.

Let us open our eyes: there is a beautiful glow on Pythagoras' curtain!

References:

Collopy F. http://rhythmiclight.com/archives/ideas/correspondences.html, 1998-2001
Collopy, F. 2000. "Color, Form and Motion". *Leonardo*, 33(5), 355-360
Peacock, K. 1988. "Instruments to Perform Color-Music: Two Centuries of Technological Experimentation ". *Leonardo*, 21(4), 397-406
Pellegrino, R. 1983. *The Electronic Arts of Sounds and Light*. New York: Van Nostrand Reinhold International.
Smalley,D. 1986. "Spectro-morphology and Structuring Processes", in Emmerson, S. (ed.) 1986. "The language of electroacoustic music". Basingstoke Macmillan.
Whitney, J. 1960. "Moving Pictures And Electronic Music". Die Reihe, 7, 61-71.

Audio-visual works quoted in the text:

Bird, S. 2005. *Border Unrest.* Keele University, U.K. http://www.vimeo.com/1244199
Bird, S. 2005. *Café Concrète.* Keele University, U.K. http://www.vimeo.com/1316246
Bird, S. 2008. Time & Tide. Keele University, U..K. http://www.vimeo.com/1237979
Burns, K.H. Abbott, M. 2003. *Copper Islands*. Composer's home studio, U.K. Available on Video DVD Sound and Video Anthology, *Computer Music Journal*, 27, Winter 2003. Also available at http://www.youtube.com/watch?v=s60ab8L_dR0
Cope, N. and Howle, T. 2003. *Open Circuits*. University of Hull, U.K. http://vimeo.com/18708106
Garro, D. 2003. Pointes Précaires. Keele University Multimedia Labs (U.K.), Department of Music. http://www.vimeo.com/10863843
Miller, D.H. 1999. *Residue*. Northeastern University of Boston. Available on Video DVD 'Seven Animations by Dennis Miller', www.iotacenter.org, 2005. Also available in the artist's website http://www.dennismiller.neu.edu
Moore, A. 2003. *Resonant Image*. Composer's home studio, U.K. Available on Video DVD Sound and Video Anthology, *Computer Music Journal*, 27, Winter 2003.
Schindler, A. and Maxwell, S. 2001. *Terra Incognita*. University of Rochester, Eastman School of Music. Available on Video DVD Sound and Video Anthology, *Computer Music Journal*, 27, Winter 2003. Also available on http://ecmc.rochester.edu/allan/html/terraIncognita.htm