Audiovisual Discourse in Digital Art

Contacts
Ernest Edmonds
Creativity and Cognition Studios
University of Technology, Sydney
ernest@ernestedmonds.com
www.ernestedmonds.com
Australia

Sandra Pauletto
The Department of Electronics
The University of York
sp148@ohm.york.ac.uk
United Kingdom

ABSTRACT
This paper discusses art systems that employ image and sound as equal elements. This can be called the evolution of the "audiovisual discourse" in art and technology. Recent software for manipulation of audio and visual material is briefly described, and audio/visual digital artworks, developed during an artist-in-residence-based project, are illustrated as examples of contemporary artistic projects concerned with this theme. Different artistic approaches in the use of audio/visual systems are identified on the basis of the historical research and the second author's work, as a technologist, in collaboration with the artists participating in the project. Finally, the role of the computer as audio/visual instrument is discussed.

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INTRODUCTION

Since antiquity, there has been a desire in human beings to search for unifying principles that could explain and summarise our multisensory experience of the world. In all disciplines (religion, aesthetics, astrology, science, philosophy, mathematics) thinkers and philosophers looked for an all-embracing harmony principle that was believed to be based on numbers. The search for a scientific relationship between colour and sound can be considered as a part of this wider search for harmony. Pythagoras discovered the relationship between musical sounds, the length of strings, and the division in octaves (van Campen, 1999), while Aristotle produced a colour theory in which he related the consonant quality of tone intervals to colours (Jewanski, 1999). In the 16th and 17th centuries, artists like Arcimboldo (Gage, 1993; in van Campen, 1999) and thinkers like André Félibien, historiographer and architect, (Jewanski, 1999) produced scales systems and theories on the relationship between colours and sounds. In the 18th and 19th centuries, instrument makers started to build machines and instruments that could stimulate simultaneously both the aural and the visual senses. They are the first examples of interactive machines with which it was possible to create an abstract audio/visual composition in real time where the relationship between the colours and the notes was predetermined by the builder of the instrument and based on some mathematical or perceptual system. These instruments were often called colour organs, and summaries of their history can be found in papers by Kennet Peacock (Peacock, 1991). Colour organs were built by Louis-Bertrand Castel (Clavicin Oculaire), D. D. Jameson, Bainbridge Bishop, A. Wallace Rimington, Frederick Castner (Pyrophone), and Thomas Wilfred (Clavilux). The term colour organ was first used in a patent application by Rimington in 1893 (Peacock, 1988). These instruments often looked like typical musical instruments, but when played they controlled coloured gas lamps or coloured paper strips lit by candles.

Recently, digital technology for manipulation of audio/visual material has become easily affordable, and a new generation of artists is starting to simultaneously combine and control materials (audio and visual) that only a few years ago were considered to belong to completely different art practices. Many laboratories and academies like the International Academy for Media Arts and Science in Ogaki-shi, Japan; the Center for Culture and Communication and the Intermedia Section of the Academy of Art in Budapest; the Zentrum für Kunst und Medientechnologie (ZKM) in Karlsruhe; and the Academy of Media Arts in Cologne, Germany, have made their syllabi based on the permanent crossing of boundaries between media and art forms (Zelinsky, 1999).

AUDIOVISUAL ART IN THE COSTART PROJECT

In January 2003 at the Creativity and Cognition Research Studios of Loughborough University, the second part of an innovative research project in art and technology, called COSTART, began (Candy and Edmonds, 2002a). The two-fold aim of the project was to study the impact of collaborations between artists and technologists on the creative process and on the development of new technology. Ten artists were approached and invited to submit technically challenging proposals to be implemented during the residencies. Technologists knowledgeable in both art practice and research, and digital technology worked in collaboration with the artists to implement the projects.

Adriano Abbado

Italian artist Adriano Abbado started his career studying electronic music at the Conservatory of Milan. His work with synthesised sounds led him to search for a way to visualise them as a method to classify them. Adriano writes: "The process of categorization has been at the centre of my interest for many years. I faced the issue when, once creating many synthetic sounds, I had to sort them perceptually to organise my work." (in Candy and Edmonds, 2002b). This search, born as a musical necessity, proved very interesting and became a research project on the relationship between synthetic sounds and abstract animation, which is well documented in Adriano's Masters Thesis, Perceptual Correspondences of Abstract Animation and Synthetic Sound (Abbado, 1988). Abbado identifies timbre as the most interesting and complex parameter that encapsulates what in electronic music today we call musical objects (any sort of sound, complex or simple). In the visual context, shape defines objects. There is then a correspondence between the spatial position of the visual object and the position from which the sound is produced.

The techniques of spatialisation of sound allow the reproduction of sound movement in space. The size of the shape is in correlation with the sound location. The brightness of a visual object is related to the loudness of the sound. The amplitude envelope of a sound (in

particular the attack) is an important element of the timbre of sound.

When Abbado came to the Creativity and Cognition Studios, he had the opportunity to use new technology for interaction based on sensors. He decided to concentrate on his audio/visual concept concerning noise. On this subject, he writes: "One of the correspondences that I find easier to set is the one between visual and aural noise. The concept of noise has interested me for a long time: I like the idea of emissive and absorbent objects: light and sound sources, on one hand, and filters on the other. Combining the two things is straightforward: filtered noise." (in Candy and Edmonds, 2002b). Using his system of correspondences between sound and visual perceptual parameters, he produced synthesised sound objects of variously filtered noise. He then created corresponding digital images. These objects form two separate sets of sequences, some audio and some visual. The sequences have higher and lower density of events per unit of time. Two ultrasonic proximity sensors allow the user to interact with the stream of audio/visual events projected on a screen and diffused by two loud speakers. A person in front of the screen can control the aural stream and the visual stream independently, by moving both hands closer and farther away from the two sensors placed on the floor. The audience can control the balance of sound to images in the audio/visual stream.

Figure 1: An Abado image typical of those used

Jack Ox

The work of American artist Jack Ox focuses on "translating" music compositions into visual works. A recent project is The 21st Century Virtual Color Organ, a collaborative project between technologist David Britton and the artist. Ox selects musical compositions, normally not composed purposely for her work, and creates digital visual representations of them based on a system of strict correspondences between musical and visual parameters. These representations are then placed and experienced in interactive, immersive, virtual reality environments. The 21st Century Virtual Color Organ is the computational system for translating the musical compositions into visual performance. It uses the information about sound that can be gathered from the MIDI files to produce 3D visual images. Britton is responsible for the graphics programming and the meta-architecture of the programming structure. Ox contributes to the concept, visual images, musical analysis, visualisation systems, and texture maps. There are two basic visual levels: the background visual environment where the sound and visual objects live and the objects themselves. One example of background visual environment is based on images gathered by making very-high-resolution photos and then detailed pencil drawings in the studio, which are scanned into the computer.

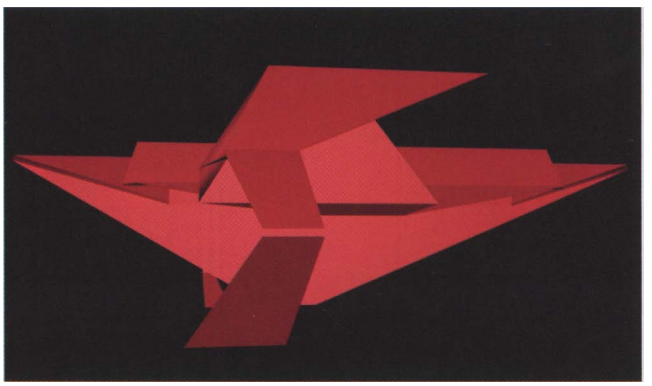

Figure 2: One of Jack Ox's images generated in the COSTART residency

The relationship between the music and the choice of these images is based on a metaphorical correspondence. For example, eight different desert landscapes are photographed, and each one is connected to a particular family of instruments. The sound and visual objects are created by applying a transparent layer of colour over the landscape image. Embedded polygons are created over the virtual desert by playing MIDI files. The characteristics of the MIDI files determine the shape and colour of these objects. A recent colour system created by the artists is based on timbre. During her COSTART residency, Jack Ox produced many 3D models (using the software 3d studio max) of objects corresponding to the sound files created by composer Alvin Curran for her next performance, called Gridjam, an interactive piece in which the participants have the opportunity to "jam" together by triggering the sound files and their corresponding visual objects.

Yasunao Tone

Japanese artist Yasunao Tone's background is in music and performance. He was part of the Fluxus art movement of the 1960s, and his work is rooted in the concept of "Intermedia" defined by Dick Higgings in 1966 (Higgings, 1966), where different media are fused together by integrating elements from different environments into one structure. Tone's recent work is an exploration of new relationships among text, sound, and images. As a starting point, he uses Japanese poems written with Chinese characters. Already in themselves they are a fusion among sound (the spoken text), images (the images of the Chinese characters (ideograms), the images evoked by the poems, and the meaning of the text. Tone does not create a

system of correspondences among sound, images, and words external and applicable to different art works. Instead, he converts one medium into another, images into sounds, and brings to life the sounds that are intrinsic to an image, just as sound, image, and meaning are intrinsic to a Chinese character.

Figure 3: A still from the video illustration of Tone performing with the Soft-board

In Molecular Music (1982-85), light-sensors arranged by the composer on the surface of a projection screen interpret the visual form of a projected image and send that information to sound-producing instruments (Ashley, 1993). Digital technology proves to be central to Tone's work, as he explains: "The digitizing process equates all the differences from the sources like visual, auditory, and textual materials with the same binary codes. Therefore, conversion among text, sound, and image has an inherent necessity for digital technology." (Candy and Edmonds, 2002). During his COSTART residency, Tone had the opportunity to add a live-performance dimension to this kind of work. Technologist Mark Fell knew the artist's work and proposed thathe use a "softboard" as a performance instrument. A softboard looks like a normal white board, but the movements of the pen can be tracked and sent as digital information to a computer. The software Max/MSP was used to read the data from the softboard and convert them to XY coordinates. These coordinates then identify a pixel of a chosen image. The digital data coming from the pixel (for example, brightness) and the XY coordinates control the parameters of sound synthesized in real time with the same software. Tone drew the Chinese characters onto the softboard, and his strokes were immediately converted into sound, creating a performance that impressed the team by its relentless searching through the sound and imagescape of the piece.

Ernest Edmonds

Ernest Edmonds' abstract visual work is time-based and uses generative procedures that relate closely to those often used in music today (Edmonds, 2003). A series of collaborations have taken place throughout the 1990s and beyond, in which composers have worked with him to make audio/visual abstract performance pieces. The underlying concepts for all of these works is that a single structural form generates both audio and visual representations. These audio and visual representations are not necessarily equivalent. They need not have a one-to-one mapping, but they are part of the same underlying generative structure. Mark Fell, a member of the COSTART technology team, is also a sound artist and is the most recent collaborator with Edmonds.

Four "works in progress" have been composed to date. In each case, a generative system was implemented in Max/MSP that produced a sequence of vectors according to a particular set of rules. The programs incorporated two sets of parallel mappings from these vectors to image and sound data. The implicit correspondences between audio and visual information are not intended to correspond to any particular physical or psychological theory. Rather, they constitute the specific aesthetic of the given work. In both domains, the style is very minimal and the works can be seen in part as developments from the "systems art" tradition (Bann, 1972). For example, the visual element might consist of a changing display between one and eight stripes of closely related colours. In one case, there are just two stripes, and the saturation gradually increases during the piece whilst the hues are selected by the generative system, and the brightness of each stripe is under the direct control of a different performer, the audio parameters being treated in a parallel manner

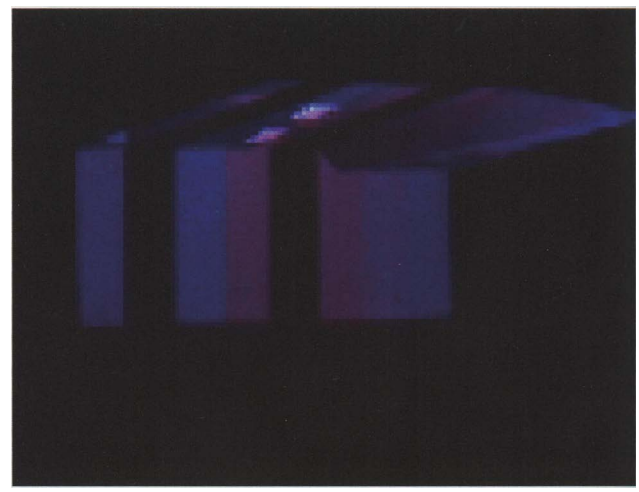

Figure 4: A still from the performance of one of Edmonds' and Fell's works

DISCUSSION

Film and television relate the audio and visual mostly to form a narrative. Audio/visual works such as those developed during COSTART are abstract and do not represent some possible reality outside the work, such as the sea or a landscape. The relationship between audio and visual parameters can be mathematical, metaphorical, or intuitive. In some cases, the digital source used to synthesise the audio is used to synthesise the visual as well. Audiovisual works exist in a space of possibilities (Figures 5 and 6).

We can distinguish between interactive works and non-interactive works. Films are examples of non-interactive works in which the audience cannot change the flow of the audio/visual material, while, for example, Abbado's Interactive Noise is a piece centred on the possibility for the audience to interact with the audio and visual material and, therefore, experience how these two aspects of the same piece interact with each other. There are different ways for the interaction to occur: the audience or the performer can be allowed direct interaction with only the audio or the visual material, and then, respectively, visual and audio are generated as a consequence. There can be interaction with the audio/visual object as a whole, or direct interaction separately with the audio or the visual material can generate a combined response.

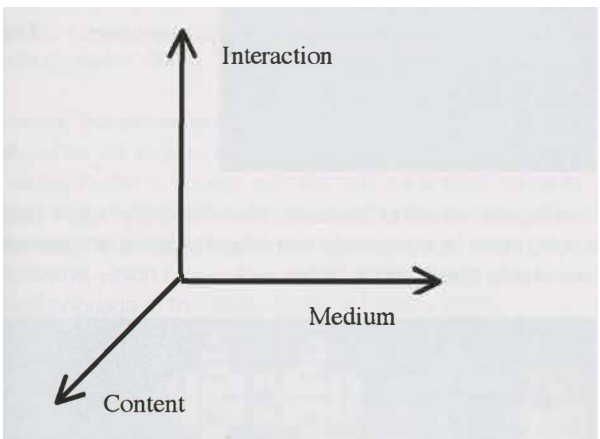

Figure 5: A space in which to place audiovisual works

These different approaches represent ways of exploring, using, and manipulating the same theme: the relationship between audio and visual and how we perceive it as a whole. In this context, the computer appears to be a very flexible and open instrument for manipulating and integrating audio/visual material. The computer can be considered the audio/visual instrument par excellence because of the transformation of both audio and visual material into the same type of digital information. This sort of new equation of the two fields allows the treatment of audio/visual material as a whole and, as such, opens new exciting challenges for digital artists. The recent development of software for the integration of audio, visual, and interaction is also proof of the contemporary interest in multimedia or "intermedia" art works. The audio/visual works developed during COSTART not only represent different creative approaches to the audio/visual theme, they also explore the flexibility of digital technology in this context.

Interaction: none/audience/media/both
Medium: still image/moving image/sound/audio/visual
Content: narrative/sound from image/image from sound/audio/visual

Figure 6: The three dimensions of the audiovisual space

CONCLUSION

There is a significant history of the evolution of the relationship between the aural and the visual realms. It is a history of scientific discoveries, evolution of technology, perception studies, and artistic outcomes. Technology developments in the 20th century and, in particular, the development of digital technology, have made finally explicit what we call the audio/visual discourse. The panorama of artistic works that can be placed inside this discourse is not at all uniform either in terms of form, content, or media used. The authors have attempted in this paper to outline a broad classification in order to show how very different artworks can be considered part of the same artistic discourse. Finally, attention is focused on the art projects developed around the COSTART Project as examples of artists' concerns and their particular use of digital technology as the chosen instrument to produce such works.

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