Macaroni Synthesis: A Creative Multimedia Collaboration

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Abstract

The paper describes a collaborative project between an HCI team and an internationally known Japanese artist, based in New York, who was artist-in-residence with the group in the UK. The collaboration resulted in a new performance art work and a new interactive instrument. The research included a full study of the *process* of collaboration and innovation. The paper describes the work that was created, the interactive instrument developed and illustrates its use in a performance.

1. Introduction

The Creativity and Cognition Research Studios (C&CRS) [6] were established for the purposes of developing new art and technology projects and to conduct research into the creative process. It is the result of a collaborative venture between the Department of Computer Science and the School of Art and Design at Loughborough University. In the COSTART Project 1998-2003 [5] an innovative approach to the study of technology-based art founded on practice-led research methods has been developed. The approach is based upon artist-in-residency studies, gathering and analysing qualitative data and disseminating new knowledge on the basis of the evidence [2,3,4,11].

Research issues that are under investigation at C&CRS include: the impact of the technology on creative practice, the implications of such practice for technological requirements and the environments in which new developments can take place. The work centers on the practice of art making.

The involvement of the artists in the electronic media is as much concerned with developing and defining those media as with employing them in art making. Whilst art and design oriented application programs are often used, the art practice is normally dependant upon writing computer programs, often interfaces between the various devices needed to facilitate interaction. The artists at the leading edge of technology-based work are rarely confined to using single software applications that can be bought on the high street. Instead, they are most often seen to be extending the media and exploring the means of developing new technological capabilities. As is often the case in innovative art making, artists are deeply involved in inventing and defining the media that they use. If this requires new knowledge and skills, they acquire it either by learning it for themselves or through their collaborators. For this reason, collaborations with technical experts who can construct and extend the technology are becoming a vital element of the work. In this respect, a significant development is the invention of computational representations of the conceptual and behavioral concepts that underpin much of the art being developed.

In this paper, we report on the particular innovations associated with one of the residencies; that of Yasunao Tone, an artist who was awarded the 2002 Ars Electronica Golden Nica prize for Digital Music [10] The residency involved three significant interacting roles: the artist, the technologist and the researcher. This three-pronged approach is fundamental to the research and has been significant in enabling and fulfilling the kind of innovation described here.

2. Background

The COSTART Project developed a new approach to the study of technology-based art founded on practice-led

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research methods. The artist-in-residency is at the heart of the process but it is a residency that differs in a number of important respects from the conventional type. First, it is a fundamental part of the approach that a residency support team with specialist knowledge about both technology and art practice is established. The COSTART team has expertise in many forms of computer systems, programming languages and devices but equally important is their personal involvement in music and visual arts practice both as researchers and practitioners. In addition, the environment into which the artist-in-residence comes is designated primarily for their use rather than on a guest access basis.

Artists are invited to submit a proposal for a new project and to specify both artistic and technical needs. The research team carries out feasibility studies into each proposal as to whether the requirements can be met and whether it has sufficient challenge technically. The research exercises involve collecting data about the collaborative creative process that takes place in the core event, a five-day residency. This period is followed up with further development work in preparation for the exhibition of works that arise. The study data is analysed ready for publication in reports and papers. It is central to the approach that the research process and the creative practice take place in tandem and that the experience for the artist represents a realistic situation.

The background to the practice-based research approach that was first developed in the COSTART-1 project is described in Chapters 3 and 4 of *Explorations in Art and Technology* [3].

3. A Residency Study

Yasunao Tone is often associated with the Fluxus group that began in the 1960s [8]. Throughout the 1960s and 1970s Fluxus evolved into an international art movement, notorious for its refusal to accept traditional ideas about art, culture and authorship. Through a series of events, happenings, performances and installations Fluxus became one of the most radical movements in contemporary art of its day.

As the artist put it: “I have pursued totally new relationship between text and sound aside from traditional lyric-melody etc. and more trendy Textual music as well. *Molecular Music* is (1982-5) is an earliest experiment as such. The piece is based on the poems written in Chinese characters including three poems from the Tong Dynasty as well as the 8th Century Japanese poem. The Chinese characters of the poetic text are grammatologically studied first and then, appropriate images are chosen from found photos. Then, they were filmed as if an animation movie was taken. Rhythmic structure of the spoken text is transferred to the structure of the film. The piece employs the sound-generating system includes light sensors attached on the film screen and oscillators connected to light sensors, so that the film projected on the screen creates varying sounds in accordance with the specific arrangement of the sensors and the changing brightness of the projected images.

Another case in point is *Trio for a Flute player* (1985), which consists of three components. These components are based on a single source, poems from the 8th century Japanese anthology, the Man'yo-shu. The curvy line of calligraphy of the poem, overlaid by musical staff, does not correspond with pitches or any tonalities but with the player's finger placements. (Note that a flute player uses nine fingers, coinciding with the number of lines and spaces of the staff — five lines and four spaces). Fingering, with its movement and pressure, triggers on electronic sound, varying in pitch and intensity, which is generated by an oscillator with a capacitor. The poems are read through the flute mouthpiece.

Yasunao Tone’s process for working with the conversion of calligraphic drawings into sound is very time-consuming involving as it does changing first Chinese characters into images and then the images into sound. Such time scales restrict the use of real-time interaction with his work. The aim for the COSTART residency project was to explore the possibilities of sound representation in real-time. The intention was for the development of a program for performance that could focus on the interaction between image and sound. The Soft-Board made it possible to do live performance in which, instead of having to transform the text into images with pictogram-like Chinese characters, the artist draws calligraphy on the board and transform any text into sound.

The concern throughout the residency was how working with an artist of this nature influenced the process of making the work, and how a rejection of prescribed methods, tools and structures changed the way in which software systems were developed. This activity was further complicated because the apparent divide between the work and the means of making the work. So there was no point at which we were making simple tools or technical solutions that would later be used by the artist to produce the work itself. The work was both the system and process as much the outcome of these activities in a performance.

In the pre-residency discussions for Yasunao Tone’s residency, it had seemed that it would be interesting to make data about his drawing gestures available computationally. The idea was that he would draw on the *Soft-board* [12] in our studios. This device looks like an ordinary whiteboard but has the additional capability to detect the position of a pen on its surface. This information is output via a serial cable and can be used to keep a dynamic record of developments in a meeting, for example.

This was an ideal way to explore Yasunao's use of calligraphy and how it can be transformed into sound.

When it was suggested to Yasunao that a variation on granular synthesis to generate sounds could be used, he said that his idea was more like 'macaroni synthesis, because it already had a form'. Tone explained to the COSTART observers in the final interview of the residency what he meant by that:-

YT	Oh!… I have a piece called "Molecular Music" which… the title itself is "My Dissatisfaction with Computer Music". Computer Music is a kind of… started from atom. Yes…… so I start from molecules not from atom. And this time I told Mark "This is a macaroni"….its developed through the granular synthesis. Granular synthesis is …he obtains certain small tiny bits of a wave form and in the building, so doing you have to make a pitch how you make yours, you have to do the same thing as I know, take academic computer music So I don't like that. So instead of grain I use macaroni.
LC	Well there's some cooking required after that.
YT	Yes cooking
LC	Is it cooked macaroni first or…the basic ingredients.
YT	Yes basic ingredients
LC	the performance is the cooking?
YT	Right

When the team try to imagine a system that transforms the movement of a pen into a sound they almost inevitably started to think in a certain way – to define a complex system of conditions, choices, relationships, behaviors, where a given input is mapped to a particular parameter and a certain kind of intervention has a certain kind or result. This kind of method seems true of most explorations of correspondence between image and sound through interaction.

According to this approach a perfect system might be one that is flexible enough to generate an almost endless series of tonal variations, yet be controllable enough so that each one makes musical sense. In making such a system we primarily concern ourselves with two types of question, firstly about how data is mapped to sound, and secondly how we might operate the system, how we know what it will do under certain conditions and how we become skilled in its use. The ultimate assumption is that the system is a tool or instrument of expression, and that this knowledge will enable the artist to control the system, so the he or she can articulate and communicate something about their feelings or beliefs. There are works that employ the opposite approach, ones that make the relationship between input and output problematic by creating systems that range from seemingly random, to ones whereby the uses grasps some sense of what they are doing, but are unable to understand fully.

Figure 1: Yasunao Tone using the Soft-board

It was known in advance that Yasunao's work embodied the polar opposite of these issues. Accepted knowledge gained in addressing such issues would be called into question (or even, totally ignored). Such work not only challenge ideas about art, technology and creativity, but in doing so presents new perspectives on sound and image correspondence, generative systems and human computer interaction in a widest sense. However, these kinds of issues are not of central concern here, notwithstanding there interest.

4. A New Instrument for Interaction

The interaction device made during the residency uses the Soft-board upon which the artist draws a series of strokes. The Soft-board sends information about pen color, and pen position to software that is used to synthesize sound. Projected onto the soft board is a sequence of video images selected by the artist. As the artist draws, the video image advances frame by frame. Data is taken from the x-y co-ordinates, the speed of movements and mapped to synthesis parameters. For the duration of the residency the sound was relayed using a pair of Tannoy active reveal monitors playing at high volume.

The system was developed and implemented in Max/MSP, which is a graphical programming environment made by Cycling 74. At the time of making the work the third author was an Alpha Tester for the Jitter objects for Max. These enable the integration of real time video and 3d graphics into the Max environment. The Jitter objects were developed by Joshua Kit Clayton at Cycling 74 [11]. Some third party objects were also used in the system, these included objects from the PeRColate collection (Dan Trueman and R. Luke DuBois Computer Music Center, Columbia University), and Lobjects (Peter Elsea, University of California, Santa CRUZ)

It was decided to make an effective interpreter within Max/MSP. This object receives the stream of data from the Soft-board and outputs information about the color of pen being used, together with its position on the surface of the board and information about when the current drawing stroke began.

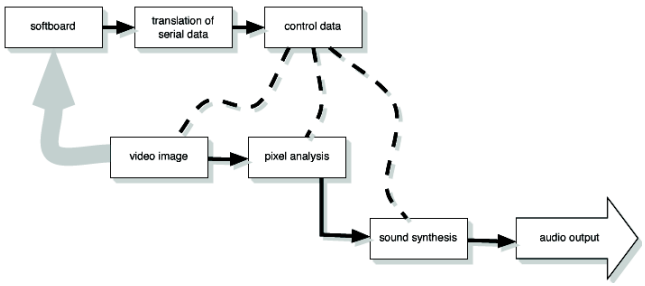

Figure 2: Flowchart of the transformation process

The Soft-board is connected to the computer using a serial port. It sends a collection of items of raw data as described here:

- Information about pen color, black, blue, red, green or eraser.
- The x-y coordinates of the pen position when it is placed on the drawing surface.
- After an initial pen down, the delta position is sent at a regular interval until the pen is lifted off the drawing surface.
- The time that the pen comes into contact with the drawing surface.

From this raw input we were able to calculate the absolute position of the pen while it is in contact with the surface, and also the speed or velocity of movement.

A video file was also loaded into the system. Jitter was used to integrate video playback. At each pen down event, the video was advanced by one frame. The position of the pen is used to select a specific pixel of the frame. The brightness of the pixel is read and used in the synthesis algorithm.

4.1 Sound Synthesis

The fundamental frequency of each sound generated is determined by the brightness of the pixel. Each pixel has brightness that generates frequencies in the range 0hz to 10khz. The brightness value is also used to multiply the amplitude of the sound, which results in distortion

When the pen is placed on the surface, the volume is switched on and when the pen is lifted off the volume is silenced. Thus, sound is only heard when the pen is on the surface. When the pen is placed at the outer extremes of the board along the x axis (to the far left and far right) only the fundamental frequency is present. As the pen moves closer to the center the harmonic content is changed, the first harmonic is introduced, then the second and so forth. The speed of movement in the x axis (horizontal) is used to determine the volume of sound. Slow movements in this direction create quite sounds, and fast movements create harsher sound. At the very center of the soft board drawing area, a small square is defined. When this area is drawn in it produces white noise.

5. Three Viewpoints on the Collaboration

In this section, three viewpoints on the collaboration are presented: the technologist, the observer and the artist each gives a first hand account of how they saw the situation.

The role of the technologist, in this case, was both as a technical assistant and as the (appropriately deferential) creative partner in the technological development. Two people were involved and one was a sympathetic artist himself as well as the technology expert. It is that technologist who reports first below.

The role of the observer is an important one in the COSTART methodology and has been described elsewhere [2,3].

The artist's perspective gives a true end-user evaluation as well as the kind of perspective "from the horse's mouth" that can rarely be inferred from a research analysis.

5.1 The Technologist

"Reflecting on the project, it seemed that somewhere in the contradictory traditions within which this work is often placed, there is an attempt to confront the notion of things having a purpose. The Fluxus artists found this idea to be quite unimaginative. It takes us to a place where we can only ever talk about the relationship between the mechanistic and the metaphysical, about ideas and ways of embodying them, about the meaning of things being separable in some way from the things themselves. This

'containment metaphor' is mirrored throughout western thought and is evident for example in the belief that the artwork is a container of meaning, or that the body is the container of the soul. Accordingly, the mechanistic is simply a means to a higher purpose or metaphysical goal. But here there is a questioning of this belief, where things are given the space to reveal themselves, not simply their 'cargo'. John Cage explains his music 'not as a communication from the artist to an audience, but rather as an activity of sounds in which the artist found a way to let sounds be themselves'[9].

Here art objects and technological tools are not considered to be different types of artifacts that sit at opposite ends of a process. They are not isolated sets of thing that we can categorize or sort according to their status or function. They present use with a *system* not a collection, the principles of which are not implicit in things themselves, but are articulated in the ways of using those things. Hence, when an artist of this kind makes a work, the making of the work (and the work itself) does not simply undermine the conventional purpose of an isolated object, but in doing so attempts to free a *process* (the way of doing, the way of making) of its purpose. It asserts a kind of reverse teleology, and undoing of what has been done, or a rejection of that which is thought of as inherited. Chang-tzu, one of the founders of philosophical Taoism suggests that 'language must by necessity be employed as a tool, but in such a way that it will create the conditions in which it is no longer useful'[7]. Much later (and in an entirely different context) this sentiment is echoed by Baudrillard who argues that 'One must free language of its purpose' and that 'the deprogramming of language will be the work of language itself. The deregulation of the system will be the work of the system itself.'[1]

There may be many works that display this approach. By placing an emphasis on the process (the making or the system), they eradicate the notion of an identifiably fixed outcome and undermine the myth of an indefinitely adaptable means (one that necessitates the control of an artist). In disrupting this equilibrium a question is posed that challenges many of our beliefs about art, technology and authorship.

Yet, in making *this* work (within the residency) we were confronted with an entirely different problem. How is this approach compatible with the use of complex tools and systems and how can such entities, processes and environments be given the space to 'reveal themselves'?

Imagine a line. Imagine that this is a sort of means<>end continuum. At one end of this line is a set of specifications (and a designer) and at the other end a product (and its user). The development process is the movement of things forwards and backwards along this line. But ignore the traffic. Instead imagine the user turning round and looking back along the continuum - he sees it disappearing into the distance. Now image him moving gradually towards the opposite end of the continuum, he keeps moving until he reaches the very end where the line stops. What does he see now? …. That is what I saw when I met Yasunao Tone.

Part of our work in the Creativity and Cognition Research Studios is to ask how software is made, to look at software the way one might look at any other text, to unpick the development cycle, to questions the design process, to move things from the margin to the center and vice-versa. In posing these questions we aim not to find a way of making things better or closer to perfection, but instead just to ask how in another context things might be different."

5.2 The Observer

It was not possible, nor indeed desirable, for the observer to constantly be with the Artist and Technologist; occasional visits are sufficient to monitor progress and to evaluate the interactions taking place.

In almost every case when the artist and technologist were observed the situation was the same. The technologist appeared to be working at the computer and the artist was sitting nearby, and at times separate from the technologist. Thus, on one occasion the technologist was programming and the artist was reading his e-mail. Close observation however revealed this superficial view to be deceptive. It was quite clear that the artist was always in total artistic control of the developmental process. He might not have fully understood the details of the technological solution proposed but he was clearly aware of the artistic implications of the system being developed.

Hewett in his comments on being an observer for the COSTART 1 project [3, chapter 13] expresses the view that "Artists need collaborators who understand or are empathic to their goals and their need to exercise control for themselves". The collaboration between technologist and artist was an example of this model in practice. It was clear from the start of the week that the technologist was aware of artist's aims and endeavored to support them to the best of his ability. The artist was content to leave much of the innovation and development of the system to the technologist, whilst retaining overall control of the artistic process. Whenever the work appeared to move away from his chosen objectives, he firmly took control and redirected the effort. The technologist complied with this subtle yet stern redirection, conscious of his overriding desire to support the artist to the best of his ability. Indeed, there were a number of cases where the technologist felt that the change appeared retrograde. For example, on the fourth day, the artist insisted that stereo separation was important and that each stereo channel produced a different sound. The technologist's view was that the monophonic sound was better however he made no attempt to control the

outcome, deferring, almost without comment, to the artist's decision. It often felt like observing a craft-master working with an experienced journeyman."

5.3 The Artist's Perspective

"At Loughborough University, I was lucky enough to have been assisted by Mark Fell who had known my previous work and understanding my ideas suggested me to use Soft-board for the visual to sound conversion. The system of SoftBoad has detect movements of hand drawing with the markers on the board with the accuracy of pixel by pixel, then the drawn lines are converted to binary data and stored in a computer for processing.

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

The program that using Max/MSP enables to make parametric variants through scanning lines of video image from the harmonics we create beforehand. Also, it makes possible tracing positions of moving hand with a marker to coincide the sound distribution of pitches and timbers. So a stroke of calligraphy or tracing outline of an image invokes great variety of sounds. Soft-board has advantages over other device I have used, which are:

First, it makes possible to do in live performance situation, by combining with Max/MSP. Second, when I have created pieces I mentioned I had to transform the text into images, which is only possible with pictogram like Chinese characters. With Soft-board I don't need to transform Chinese characters into images but simply draw calligraphy on the board. Also, it enables any text into sound. In only five days it was quite an achievement".

6. Conclusions

In the Yasunao Tone residency, a highly challenging view of human-computer interaction was taken. It lead to the development of a quite novel interaction device that formed the core base of a new creative performance artwork by Tone.

The nature of the study undertaken, in which the roles of artist, technologist and researcher were allocated equal place, was highly effective in stimulating innovation. As well as enabling valuable research into the creative use of technology, the approach can be used to stimulate the creative development of technology.

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