Composers' Desktop Project: a musical imperative

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1. STRANGE BUT FREQUENTLY ENCOUNTERED SCENES

In the early 1970s, you could have gone to Trevor Wishart's front garden on St Marys in York and found huge slabs of steel sheeting. You could have walked into the Lyons Concert Hall of York University and found him and several other people using 20' scaffolding poles as trumpets (now that's a great sound!). While I was still in the States in 1969, I made a 3' diameter red gong from the hood of a truck (= bonnet of a lorry) and could be seen striking a suspended piece of $\frac{1}{4}$" curved steel flooring with a sledge hammer, etc. etc. Scenes like this were duplicated across the world. Why? How did it start? *Sounds*, *sounds* – the sounds were there, they wanted out. How did they get in? Anyone's guess, really, but maybe a clue is what often happens while working in the studio. You've been developing a sound and then seem to hear it at a time when playback is switched off, then realise that it's coming in from outside the building. The sounds are out there in the environment. We have ears (and other ways of sensing vibrations) and so the sounds have found a way to get inside us. Now they want out again. Composers: they just can't help it.

2. A MUSICAL IMPERATIVE

This is an article about the Composers' Desktop Project (CDP), its origins and its aspirations. The key point I would like to make, to illustrate, to communicate, is that it is *music driven*, that there is a *musical imperative* that is driving us. What I mean by this is that there is something which is *in* that wants *out*, wants out with a passion, like a natural force, like water flowing from a spring, like the ice breaking up and churning seawards in an arctic river at the end of winter. Music has been evolving in a major way for many decades now, and has not been doing so for nothing. It's not whim, or 'experiment', or *just* fun (though it is fun), not something arbitrary or a result of unbridled wackyness. It's a natural force, it has to happen. Because the sounds are inside, and they want out – badly. It's unstoppable.

I'm not trying to be poetic in saying these things. I'm trying to say in a direct and honest manner that something is happening, *has* to happen, in fact something which has already been happening for a long time, something that will enhance the nature of music forevermore. The word 'enhance' is chosen carefully. The inclusion of 'sound' as a part of the fabric of music is not, in my view, an alternative to the use of clearly pitched 'notes'; it's an *extension* of musical discourse – an extension which I believe ultimately, in its most challenging aspect, needs to be integrated with the whole of that discourse. In various ways it presupposes and sometimes stimulates and influences the presence of types of music-making which are not directly electroacoustic.

I speak as a composer, which means that this is my *experience*. This is what I sense and feel and imagine and can't do otherwise because it is simply there. That's why I've devoted the past 10 years to work with very esteemed colleagues to coordinate the activities of the CDP. I've been driven to it; we've been driven to it. It comes from inside. Along with many other people individually and in groups throughout the world. **It's one of the greatest and most exciting moments in musical history – the evolution of music into sound, 'organised sound', and the opportunity to harness the enormous computer power now available to help do it.**

3. ONCE AGAIN, WITH FEELING

We are dealing with more than just the sounds in themselves: also the felt dimension of sounds. Somewhere inside oneself a connection is made between sound and feeling; this is what enables and leads a person to be a composer. Not crude psychological categories, but an infinitely subtle panoply of responses to life. The composer *feels* the difference between a first and a second inversion of a chord, *feels* the lift of a rising 6th, *feels* the stasis of an extended harmonic prolongation, travels in spirit along the long arc of a Renaissance contrapuntal melody, intuits the inner meaning of every minute change in the attack and spectrum of a sound. It is not just the sounds themselves: it is also their

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relationship to one another in time (the score). And so music is born into the world.

The computer power which first put men on the moon is now far surpassed by what's in a digital watch. The computer power available for musical processing today is simply incredible. *So incredible that it's approaching being just barely enough*. The composers of today have a far-reaching vision that demands all the processing power computers can deliver, and then yet more, often many millions of operations each second: a vision of all kinds of sounds and sound transformations, of sounds which flow out of an acoustic instrument, change and evolve and are heard in new forms without a noticeable delay, of new kinds of electronic/software musical instruments, of new types of musical processes and forms of organisation, of interactive on-the-spot manipulation of the sound generating equipment, of musical processing engines which are responsive to the live performer... Music for a multi-cultural One Earth, music for a cosmic civilisation, music created and disseminated across communication networks, music evolved together with visual images, music that understands and appreciates the deep structure of many musical cultures and works to develop them into something more, new art forms that integrate all these things.

I've let myself go a bit, but deliberately. I want you to see into the real me, to know that I (and my colleagues) are not playing at CDP. That we are driven by inner necessity, inspired by the possible vistas opening up in the field of music today, thrilled at being able to use and develop incredible tools with which to travel into these vistas. Nothing unusual, really. Not news to the readers of *Organised Sound*. Not really different from any of the rest of you. But this is where the Composers' Desktop Project is at: *composers*, driven, want the tools and want them accessible at all times of the day and night on their *desktops*, working cooperatively together as a *project* to create whatever new tools their respective inner visions require.

To understand CDP and probably many other studios, research facilities and companies, *one has to understand that for us the composer's vision is the driving force*. And to keep moving forward, one has to keep in touch with this vision, and to bring the results to the people whose lives will be enriched by the evolution of the materials and forms of music, through concerts, broadcasting, CDs, etc. Sometimes even we get lost in the technicalities, but what we as an organisation value above all else is the composer (whatever style!). Our commitment is primarily to tap into the composer's vision, to make the tools that that vision requires, to do so by sharing expertise, to keep the evolution on-going, to offer help in the preparation of customised applications, and to make everything available to others.

4. AND SO WE GOT GOING

We began the CDP in 1986 with a feasibility study to transfer the mainframe version of *Cmusic* to the Atari ST (mainly Andrew Bentley, with Trevor Wishart and Richard Orton). This worked, and sound out was achieved by off-set addressing the cartridge port (Martin Atkins) and the construction of the *Sound-STreamer* I/O device to convert the cartridge port data bursts to a steady audio stream (David Malham). The first batch of these were manufactured by Audio Design Ltd, with a circuit board designed by David and made by Precision Etching Ltd. Andrew then devoted several months to creating our first set of 'Groucho' sound processing routines (after the Marx brothers, esp. Harpo), Martin created a set of Unix-like utility programs and an operating system for handling sound on the Atari, and Rajmil Fischman wrote a graphic user interface for Play and Record, etc. I was a lesser member of this highly-skilled technical team, sharing the musical vision and encouraging the work, but without their level of technical expertise. I found a natural role later on when I began to concentrate on preparing documentation, handling the sale and distribution of the first CDP Systems (1987), liaising with the membership and coordinating further development. This was among the first direct-to-disk digital sound processing systems in the world.

Initial funding from the Gulbenkian Foundation and the public domain policy of CARL (*Cmusic* and the *Phase Vocoder*) and later MIT (Barry Vercoe's *Csound*) gave our software base a kick start. The Groucho programs began by emulating the processes of the 'classical' (= analogue) studio, gradually expanding into processes which were done much more easily and at times only in a digital environment, such as complex segmentation and envelope processes. Groucho authors include Martin Atkins, Andrew Bentley, Peter Bowcott, Richard Dobson, Rajmil Fischman, Tony Hood, Nick Laviers, Bertrand Merlier, Richard Orton, Neil Slater, and (primarily) Trevor Wishart. His friend Geoff Beacon, a professional programmer, gave Trevor his first training in C programming, thus opening the door to his future life-work. Not long after, with the help of technical staff at IRCAM, Trevor wrote the first 3 programs to manipulate frequency–amplitude (FFT) analysis data. He has since expanded this to over 50 programs, which now constitute the most original, powerful, and specifically digital part of our system.

In the early 1990s, Martin Atkins masterminded our port of the system to the PC and SGI platforms, which has led to a massive increase in processing and breathed new life into the Project.

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5. OVERVIEW OF THE CURRENT CDP SYSTEM

The following partial listing of CDP software has grown 'from below', i.e. mostly from composer input. These programs operate in a direct-to-disk non-destructive command line environment.

5.1. The 'Groucho' time-domain processing programs

- *Soundfile utilities*. 12 programs, mostly to get information about a soundfile.
- *Numerical utilities*. 14 programs for information about or processing of sets of numbers.
- *Amplitude*. Means of getting information about amplitude levels and optimum gain factors.
- *Distortion*. 13 programs, of which 9 operate on pseudo-wavecycles.
- *Editing/mixing*. 24 programs focused on NEWMIX and including a 'meta' mixfile processor to reorder and retime events according to various criteria.
- *Enveloping*. 7 programs offering the ability to reshape, extract, impose and modify envelopes; ENVTRANS has many envelope modification options, both fixed and time-varying.
- *Filtering*. 9 programs offering completely definable banks of filters and many time-varying features, such as time-varying Q.
- *Granulation*. The key program here is GRANULA, a powerful program to create granular textures; it has 3 required and 11 optional parameters, almost all of which can be time-varying. These are also 6 programs to manipulate a soundfile consisting of separate grains.
- *Segmentation*. 8 programs to use digital technology to the full to segment a soundfile and construct a new one from the segments in many different ways.
- *Spatialisation*. 5 programs which handle the spatial placement of soundfiles, particularly pan and doppler effects.
- *Synthesis*. 5 programs with which to create basic signals; also *Csound* (see below) with its many sound generating methods.
- *Transposition/Extension*. Time-varying transposition is essential, but transposition also enters into the operation of several other programs concerned with texture-building. Downwards transposition outside the spectral sphere 'extends' a soundfile; the other programs in this category extend a soundfile in other ways, such as iteration, echo effects, and delay lines, fixed and time-varying.

5.2. *Csound* and the CDP *Csound* extensions

- *Csound*. CDP maintains a reasonably up-to-date version of *Csound* on the Atari 030 machines, PC and SGIs. This brings into the system *Csound*'s extensive sound synthesis and modification facilities, as well as the algorithmic potential of *Cscore*. CDP's version of the latter enables the use of an indefinite number of command line parameters, so that a user-application can be used experimentally more easily.
- *CDP Csound Extensions*. CDP has a number of programs to write *Csound* score/orchestra files, thus providing advanced tools for creating complex effects: GRANSYN for granular effects, WEDGE for wedge-shaped textures of events using one or more soundfiles, REMIX for texture-building on a grand scale.

5.3. The spectral frequency-domain processing programs

It is very hard to summarise the range of processes that Trevor Wishart's spectral manipulation suite encompasses. They act on the windowed frequency–amplitude data of the CARL *Phase Vocoder* analysis file. The following is a listing of some of the main features currently included in this package.

- *Enveloping*. Focuses on extracting/imposing spectral envelopes.
- *Extension*. Extending sounds by time-stretching (with time-varying control), freezing or expanding analysis windows.
- *Filtering*. Effects such as time-varying filters or thinning out the analysis channels, removing noise or saturating the spectrum with noise, or splitting the spectrum into frequency bands.
- *Morphing*. Three different approaches to spectral interpolation.
- *Segmentation*. Similar to the Groucho programs, but operating on analysis windows.
- *Transposing*. By spectral shifts (with or without preserving formants), fixed or time-varying transposition, extracting/tracking pitch movement and imposing the pitch movement of one file on another.
- *Tuning*. By transposing a spectrum onto a chord or replacing partials with the harmonics of specified pitches.

5.4. Summary of special features

- *Editing*. Soundfile display and editing accurate to the sample.
- *Batching*. Batching of several operations; this feature will be maintained in the graphic version of the system.
- *Time-varying*. Extensive presence of time-varying parameters.
- *Flexibility*. Multiple parameters and combinations of parameters.
- *Algorithmic options*. Including *Cscore* and Richard Orton's *Tabula Vigilans* for script-based C-type

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programming of algorithmic processes; this is currently moving from its development phase in which MIDI was implemented to a new version which will operate directly on soundfiles.
- *Programming*. Libraries for programmers' use.
- *Graphics on the Atari*. The Atari 030 systems have the graphic programs *Adsyn Draw* (draw on-screen frequency and amplitude traces to generate sound by additive synthesis), the *Keele Desktop* (for multi-window cut, paste and splicing operations, and a mix window with 16 tracks), the *Phase Mutator* (for mountain and sonogram FFT display, with editing facilities), *Midore* (for using different tunings), and *Disp* (fixed and moving FFT display).

6. LOOKING FORWARD

In the spring of last year (1996) we were invited to move our office to the Partnership in Advanced Computing Technologies (PACT) in Bristol and work, in this super-charged multimedia environment, on taking the next steps in CDP development, work in which Richard Dobson is playing a key role.

Current work is focused on creating graphic user interfaces for our PC Windows 95 systems. New hardware boards able to deliver real-time processing are just becoming available, and we are planning to take advantage of them as soon as possible. And beyond these developments, in my view, lies a much more extensive development of algorithmic software, moving beyond 'sound' in itself to matters of musical construction. With the (financial) help and encouragement of the Sonic Arts Network, we are beginning to adapt programs for use in schools and to move software to the Macintosh platform. We have also recently been awarded a grant by the Arts Council of England to help begin the massive amount of work involved in developing a system with such a large and technically advanced software base. This assistance is so very welcome!

In initiating the further development of the CDP system on such a grand scale, I am very conscious that all CDP development is essentially a team effort. I of course have my own ideas and throw them into the pot, but it is a very large pot. Richard Dobson and I have been fishing out wish lists sent in by users over the years, and are consulting with a number of key CDP musicians and programmers, hoping to be able to involve them in the development work in various ways – which leads me to the next topic.

7. CDP AND THE COMMUNITY OF MUSICIANS WORKING WITH SOUND

Our approach has been and still is essentially cooperative on an international basis. We explored the option of a more directly commercial orientation, application for venture capital etc., but it never seemed appropriate. The main reason for this was that we were thinking in terms of our own specific compositional requirements, and wanted above all else to have the functionality our music-to-be required. This was on the whole well in advance of the wider commercial market and we didn't want to get tied down to servicing packages with limited functionality. We saw our existence and purpose as a service to electroacoustic composers – using ourselves as guinea pigs.

This situation is changing now. The wider public is much more aware of 'sound' and what can be done with it, and we are now quite naturally evolving our ten-years worth of advanced functionality into a more graphic-oriented environment. More people are now ready for and need our range of software tools, and we therefore want to do what is necessary to make them more widely accessible. The field of 'multimedia' and the fusion of sound and image in film, video, animation and specifically digital art forms are also areas in which we find ourselves at home. We want to make it easier to use our system in these applications.

The international community of people producing electroacoustic music by various means, and by using computers in particular, is large and growing. CDP as an organisation is just one part of an international movement. Our approach therefore seeks to look outward as well as being concerned with our own user-base.

The outward orientation includes:

- making use of and recommending to our users the facilities of the Internet, such as the forum for *Csound*,
- participating in the International Computer Music Conference,
- contributing in kind to other international projects, such as the various contributions CDP members have made to the *Csound* package,
- promoting communication between institutions which have the CDP system in common, and
- articles by CDP members in music journals.

Regarding our own user-base, the focus is on *user support*.

User support for this kind of system is an important issue. Computer systems are complex, the multi-parametric software inevitably has a serious learning curve, both in using the software as such, and in grasping the musical possibilities it enables. We have first of all worked very hard on our *reference and tutorial documentation*, and have distributed 20 *Newsletters* to the men and women of our world-wide membership. For on-going support, many people have been very generous with their time and availability, and I have tried to maintain an open *phone*

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and e-mail line. There is so much more we can do, and which needs to be done in this area. We feel that the fairly recent expansion of the Internet provides the mechanism by which more support can be given, and expertise can be shared. The next step needed here is an on-line bulletin board (probably monitored) via which members can discuss problems and solutions, and it's about time an independent user group emerged.

Another important area of user-support is providing *libraries* which can help programmers/users to create their own custom applications. Most source code is available to individuals and institutions upon signing a non-disclosure agreement which includes the proviso that work accomplished be shared with other members (on an agreed basis). Through pressure of work, we've gotten behind in what we could be doing in this area, but should catch up as a side-benefit of the preparatory work involved in creating the new GUIs. Richard Orton's *algorithmic* program *Tabula Vigilans*, now in development for over 4 years, is a very powerful way for a programmer/composer to pursue the requisites of his or her imagination in a customised and open-ended way.

8. A SUMMARY OF KEY FACETS OF THE COMPOSERS' DESKTOP PROJECT'S PHILOSOPHY

- Maintaining contact with the creative vision of composers.
- Shared on-going development of software tools as required by that vision.
- Preparing technically helpful and musically meaningful documentation.
- Evolving the system in ways appropriate for increasingly different types of user.
- A pricing policy that favours the independent composer/musician as much as practically possible.
- Availability of user support, improving it through increased use of on-line facilities.
- Support for individual control over the system: programming tools and tools for algorithmic composition.
- A complementary role in the wider world of ever-improving commercial facilities, and in the electro-acoustic community at large.

9. CONCLUSION

The Composers' Desktop Project is proud and excited to be a part of a staggering world-wide expansion of the materials, tools, forms and aesthetics of music. It's a fantastic period in which to be alive and working. We're driven and enjoying it; it's a *musical imperative*.

Try this exercise: pick out a TV show with a varied soundtrack; darken the picture and just listen to it. You will probably hear melodies, harmonies, rhythms, MIDI instruments, acoustic instruments, voices, sound effects like footsteps and doors and wind, sound textures, and maybe even some very strange sounds indeed. The Italian Futurists got it right. Musical discourse is never going to be the same again.

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