The fractured acousmatic in performance: a method for sound diffusion with pre-composed materials

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Abstract

This paper considers some of the numerous relations that hold between acousmatic works and their performances, and proposes a compositional method that responds to the art of sound diffusion. Acousmatic works have a long and established history that goes hand in hand with a solid performance practice. It is right then to consider, as the art of the acousmatic changes and is impacted notably by technology, that the art of performance of acousmatic works might change also. We propose a ‘fractured’ approach to composition and performance, one that recognizes the need to work in the studio and create fixed forms but which affords a degree of flexibility in performance. In extreme cases, this may tend towards an open form. Breaking into the composition and performance processes may however afford a development of interpretation in performance and a greater sense of performance practice.

Introduction

The paper is divided into three parts. The first part surveys the established paradigm; for some considerable time, sound diffusion has been employed to animate the fixed media work which has, in turn, become much more malleable thanks to interfaces and software that are more appropriate to a composer’s needs. Despite this, fixed media works remain relatively inflexible in performance, notwithstanding recent developments in the capabilities of diffusion systems. Re-examining the difference between diffusion and projection may aid the potential for interpretation and performance. The second part of the paper introduces recent compositional activity using triggered pre-configured acousmatic materials (from sound objects to sections). This compositional approach has been described using the term ‘fractured’ (Moore, 2008) and it is hoped to expand this method to include sound diffusion and projection. The third part of this paper abstracts key findings from the fractured acousmatic in performance and proposes a method for sound diffusion with pre-composed materials.

1 Sound diffusion and projection: trials and tribulations

It is worth positioning this paper very carefully. There are numerous methods of composition. This paper will consider electroacoustic music composition that comes out of a tradition of musique concrète where
the process of composition comprises creative recording (figure 1), assessing, manipulating, extemporizing, experimenting and constructing (figure 2).

Figure 1: Microphone play space

In my own practice, I develop a large resource of materials and then build these up during a mix process which ‘fixes’ sections. Where sounds do not fit, I return to my development tools and search for specific solutions.

Figure 2: The work-reflect process

For the most part, my works once completed are fixed to a medium (the soundfile) and that is it. I rarely go back to a work and rarely reuse materials. I intend all of my works to be performed to a public and normally turn to the tradition of performance born out of the Groupe de Recherches Musicales (GRM) in Paris and the International Institute for Electroacoustic Music in Bourges (IMEB). From my undergraduate studies at City University working with the Electroacoustic Music Association of Great Britain to my postgraduate work with Birmingham ElectroAcoustic Sound Theatre (BEAST), my works have been dispersed through multiple loudspeakers in an attempt to bring them to life. I maintain that this dispersal reanimates the work and makes real some of the objects, scenes and emotions that are implied in the stereo file. For some time now, the term ‘sound diffusion’ has been used to encapsulate what is typically a duplication and subsequent distortion or exaggeration of the stereo image over multiple symmetrically placed loudspeakers (Harrison, 1998).

Diffusion has often implied the invisibility of the loudspeaker. There are times however, when the image to be presented requires focus: if a work had a spoken text for example. At these times the unwritten rule was to present the sound at the front on the ‘main’ pair. It was almost unavoidable not to focus upon the sound as the diffuse in diffusion had disappeared. The image was still virtual and always will be but the focus was strong enough to draw the attention towards a specific pair of speakers. Sometimes attention is drawn to the visibility of the loudspeakers when it is inappropriate to do so - a mistake in diffusion perhaps. This presence is also made explicit in the French-school acousmoniums with one off-set pair of loudspeakers (or mono sum) acting as ‘soloists’.

We are encouraged to compose for the potential of a diverse range of speakers positioned throughout the venue. This was at least the position ten to twenty years ago when loudspeaker ensembles were
all shapes, sizes and conditions. It is less the case now where a vast majority of loudspeakers are by
the same manufacturer.\footnote{To the point that some digital diffusion systems now incorporate EQ to artificially ‘colour’ loudspeakers!} Such is the possibility for reanimation through sound diffusion that works
composed explicitly for live performance can sometimes sound less good in living room conditions over
two loudspeakers. The opposite is also true: works with strong scenes and lots of focused stereo detail
are often too dense to separate in diffusion. The current tendency to master electroacoustic music quite
heavily also effects diffusion.\footnote{Diffusion retains a sense of ‘live’ mastering, especially of SPL: this is more difficult to do when dynamic range is reduced. In fact a non-mastered work will normally be compressed in performance and a fully mastered work will be expanded.}

I have mentioned cases where sounds may be pulled towards a specific set of loudspeakers. Another
case where diffusion is difficult is at section ends. Imagine a scenario where a sound drifts away (tails in
reverb, panning, spectra and amplitude), but before it is completely finished it is interrupted with a loud
sound object that requires front-and-centre exposure. In the past, my technique has been to increase the
amplitude of the distant loudspeakers to make the closing sounds physically move there and increase the
main loudspeakers in such a way that they do not overpower the distant pair. And at some point, I can
then begin to lower the distant loudspeakers.

This also stems from my technique of diffusion in general. Rarely do I effect change through addition of
loudspeakers but by withdrawing loudspeakers from a composite. Sound ‘heard’ through loudspeaker iden-
tification is less effective than sound which ‘magically’ disappears from one set of loudspeakers (effectively
appearing somewhere new - the loudspeakers that remain).

Where overlap is required, multichannel separation would be pertinent. Given that we can dynamically
matrix our inputs to outputs we can arrange for our end of section material to move out of the main pair.
This has implications of course for the spatialisation system used and the potential prescription of diffusion.

Say 1 and 2 = distant, 3 and 4 = main, 5 and 6 = side, 7 and 8 = rear

- matrix in12-out12/34/56/78 - same material
- (delay) matrix in12-out34/56/78 - fade out
Chris Rolfe’s *A Practical Guide to Diffusion* (Rolfe, 1999) mentioned ‘collapsing all 8 channels onto a single front speaker as an exit strategy.’ He continues by talking about automated diffusion patterns. The case where declamatory material is static while textured material is diffuse(d) is another example where multi-channel composition and performance merge. This highly dramatic separation can be achieved both through standard multi-channel practice and also through matrix diffusion with stem-based audio.

A further example is Smalley’s concept of canopies (Smalley, 1997). It has been difficult in the past to physically separate droned or textured canopies from material that inhabits that zone.³ By splitting canopied material to specific loudspeakers we can create interesting ‘real’ polyphonies as visualised in figure 5. The requirements for sound diffusion systems vary enormously, therefore it is vital that any computer based system have the flexibility to be programmed quickly and scale up or down to any size of system.

### 1.1 real time transformation triggers

There are numerous environments merging composition and performance in a loose framework. Integra (Bullock and Frisk, 2011) works well with existing DSP architecture and is very useful for live electronics. The Sketcher (Dahan, 2004) presents an associative approach to composition that relieves the visual interface of all aspects of temporal flow.

I am proposing something that borrows from the above, plays back layered sound-objects and affords simple representations perhaps similar to the graphics of the Acousmographe. In addition, processes may be added to objects to operate throughout the object’s course or (mainly) at the end of the object.

I am not asking for the full composition arsenal to be made available ‘live’ but I suggest the following processes might be useful to ‘drop in’.

- Reverberation
- Amplitude and EQ (Amplitude and EQ = spectral fades)

³Composers rely upon the material splitting itself purely by its spectromorphological qualities.
• Granulation and loop archetypes (bouncing ball motifs etc.)

Processes need to work as generically as possible and can be dropped in like a transition on a video editing package. The trade-off is between producing exquisite, coherent work in the studio and affording flexibility in performance through practical scheduling of events. The composer will want a work completed to their satisfaction (for radio and other concerts). This idealised system must not be so idiosyncratic as to be unusable. However, as composition processes move towards segmentation, so should our performance environments.

Taking the case of figure 6, we are seeking the continuation of a phrase in termination where we are unsure how long the fade profile needs to be. Our closing material could be of limitless duration. The fermata on our ‘descrecendo to distant’ can then be drawn out until the interpreter is ready to move on. This also poses interesting implications for performance and composition in that we may have an idealized fade out time but we need to cater for longer durations (shorter normally takes care of itself but if the material is active, any early fadeout may conflict with the spectromorphological energy of the sound). Taking the idea of maintaining a soundfile for a variable duration might mean simply extending the file in the original playback and then performing a fade out on a trigger. However, we may also wish to introduce some real-time transformation at this point such as a granular freeze with amplitude control on a slider and decrescendo at the discretion of the performer. You can’t have a ‘slider for this and a slider for that’ but you could dynamically assign sliders as the music progresses.

Figure 6: Fadeout profiles with fixed decrescendo (or ‘live’ input fade?)

For the most part we are talking about one direction in performance with fractures of varying durations
including elongated passages with amplitude control (horizontal fractures) and stratification of materials in textures (vertical fractures). However, the inventive composer may at this point wish to give the performer even more interpretive control by creating multiple routes through the horizontal (and potentially vertical) fractures.

2 ‘Fracturing’ composition: the implications for performance

In the proposed method, composition is broadly speaking constructed in a similar fashion to the closed acousmatic work but the presence of fractures may result in alternate pathways being suggested (in a similar way to the controlled aleatoric works of Boulez, Stockhausen and Lutoslawski). During the construction process, a ‘what if?’ point is reached; the composer is required to suspend a definite path and consider multiple routes within the compositional structure (figure 7). Compositional routes may (like a bypass) be brought back into line but the performer may opt to take route A or B. This may leave the composer feeling as though they may have lost some control over the direction of the work. We do this in composition already to a certain extent as the following example suggests. A composer works in the studio and begins the day with a particular sound from which they extend forwards and backwards in a through-composed style. They ‘start over’ on the following day. It is highly unlikely they will proceed in the same way with the same sounds but extremely exciting compositionally not only to compare and contrast the two paths but to keep both, think about convergence and perhaps offer these as performance alternatives. There comes a point (and I would guess it is quickly reached) where compositional flexibility negates structural flow (it just will not be what the composer wants).

![Figure 7: Composition routes and potential divergence](image)

There are many positives to this excursion in compositional thinking but they are limited by the need to create practical interfaces to support dynamic performance and by the openness of the composer’s structure. If we assume that the composer is no longer the performer of the work (though this remains the case for the majority of extant acousmatic works), and the work has degrees of openness, a definitive (if incomplete) score must be provided. Therefore, one might imagine a more collaborative performance between the performer of the sound materials and the sound diffuser, both working from the same score. This interactivity has been present in notated instrumental music for some time, with contemporary examples where scores are even constructed on the fly. The intriguing aspect of composed bifurcations is the prior compositional planning required. I am not arguing for a more thought-through acousmatic working practice but if I manage to create two paths that could be followed, I suspect I may know a lot
more about the direction of travel than in most cases where I only ever create a single trajectory!\textsuperscript{4}

2.1 Why we still work in the studio

The composition of fixed media works has always relied upon ‘out of time’ working. It is vital to ensure accuracy where it is needed, especially in cases where what is desired is impossible to achieve in real time (playing a transformation before playing the original). Moreover, the necessary levels of musical complexity present in most acousmatic music on fixed media must be taken into account. In postulating a method it is worthwhile exploring the physicality of a) combining the playback of increasingly smaller segments of a fractured work with b) a more demanding diffusion/projection paradigm.

Time in the studio is always hard to come by; physically and metaphorically. Buried in the studio we chisel at time, the analogy with the sculptor becoming ever more real. And whether our sounds are meticulously time-aligned transformations or free recordings of creative play, the mixing environment is where attention to detail is essential. It is also where the piecemeal activity of creating transformations is fused together. Mixing has a chimeric feel to it, more than any other process, even spectral manipulations are not as powerful. And as composers, we know that in the studio we may manipulate sounds knowing that they will be used deep within a mix. This is one of the bizarre idiosyncrasies of the acousmatic process. It is not all down to ‘save it and chance it’ as many might suggest. We may not know how a piece is going to develop as we manipulate sound but we know that a small, wisp-like drone may well serve as the icing on the cake of a larger texture yet to come. There are gestalt operations at work - personal, yet possessing some claim to universality. We know how the piece might develop even before we have started to mix sounds together. We are now free to store as much sound as we please. In the past, this was not the case: decisions took longer and were more destructive. We still do not have the necessary tools to document a neutral trace of the processes we take, though work at Sheffield University Department of Music has been under way for some time to support composers with the software SCMake facilitating a full log of compositional instructions for future analysis, re-creation and interpretation.

My desire to work towards a fractured acousmatic performance situation comes partly from my work for violin and triggered files Fields of Darkness and Light (Moore, 2010) and from my forays into live improvisation with electroacoustic materials. The challenge in Fields of Darkness and Light was to provide a sustained accompaniment whilst affording opportunities for ensemble work, allowing the soloist more freedom. The liberation (though time consuming) was to compose segments and then un-compose them from their ideal adding additional drone or reverberation particularly at phrase ends.

2.2 So what is a fracture?

A fracture is a pre-composed object of short to medium term duration as in figure 8. It would normally have a very obvious start, would have a well defined architecture of forward and backward cues, have sync points to allow for auto-cuing, accept user defined events, and could be given a variety of ‘exit strategies’ mentioned in section 1.1.

\textsuperscript{4} And whilst this is perhaps a more directed approach, it must not come at the expense of serendipitous moments of madness/beauty that we attempt to conjure in the studio
3 The fractured acousmatic in performance

The concept of divergence and extension in composition implies interpretation: a bifurcation opens up a new avenue of discovery concerning the composition process. In the layered texture example of figure 9 the performer requires control of input levels and output levels and potentially the control of each layer to the matrix of in-out linkages. The ‘art’ of performance becomes at once more intricate with interpretation being closely linked not only to pragmatic aspects of venue, audience and sound diffusion system, but to the ‘idea’ of interpretation (as once suggested by Christian Clozier when describing the sound diffusion system at IMEB and documented in *Composition-diffusion/interprétation en musique électronique* (Clozier, 1997)). Figure 9 affords limited freedom in selecting the start time of the second and third layers but demands a) that layer one be of a certain duration and that b) its termination be extended to enable layers two and three to finish.

3.1 Manual and scripted triggers

Figure 9: A layered texture with manual and scripted triggers

It therefore demands of the composer a score with more concrete instructions to control the degree of interpretation, as there are no guarantees that the performer will be the composer or will have significant
understanding or experience to render the best possible outcome. How can an interpreter tell when layers two and three are finished in figure 9? Clearly, interpreters can audition these files individually. Moreover, despite the acousmatic nature of the work, some reliance upon visual stimuli will be required. Soundfile start and end points can be identified on screen.

Any increased complexity of performance construction will have implications for both the dexterity and proficiency of diffusion. Throughout this proposal I have been speculating as to whether the interpreter, scheduling events, controlling input balance of separate materials could also be the sound diffusion artist. I have talked about the possibility of duo performances (and have seen them in action). This research is also fed by the need to re-assess the whole performance practice of diffusion and by making it more difficult, expose the existing hurdles that confront performers today.⁵

3.1 Multichannel versus Multi-channel

Multichannel works may also be suited to some form of fracture. However, a vast majority of multichannel works have such complex spatial imagery that they require something completely different to diffusion or, in the case of the BEAST multi-8 channel practice, ‘diffusion en masse’. Given the potential complexity in fracturing the work’s flow through time, this research will concentrate on working within a fractured stereo paradigm. The multichannel nature of this fractured work relates to dramatically separating horizontal and vertical units within the logistical framework of venue, set-up and rehearsal time.

It is important that the performance reveal some of its methodology (i.e. the drama and the contribution of the interpretor/performer) and not reconfigure a work to a point where it might as well be fully fixed. Interfaces that afford greater visualisation in performance tend to sacrifice detail and subtlety in the music for visual effect. Interaction via tablets and faders where global changes may be plotted in rehearsal may still be the best option for performance though larger interfaces (including aspects of object recognition and tracking) have enormous potential.

3.2 An interface and practical examples

There is relatively little need to discover a new technological means of composition. The DAW suffices to produce mixed segments of transformed sound, and performance playback (to whatever degree) can be prototyped in numerous languages and combined with a diffusion paradigm that is matrixed to multiple loudspeakers and control interface(s). The simplest interfaces I have used for diffusion remain multichannel assignable faders which vary in number from eight (a Behringer BCF2000), to the M2’s 32 to BEAST’s 64. Add to this a mechanism for triggering soundfiles (a computer keyboard or touchOSC screen) and we have a point of departure.

Although many programs for diffusion exist (the M2 diffusion mixer has been in use for over ten years at The University of Sheffield (Moore et al., 2004; Moore, 2004)) a prototype will be envisaged that handles soundfile triggering, scripting, matrix mixing on input and dynamic matrix output routing, a staging post for a composition in fractured form, ready to be truly interpreted by a performer.

The M2 was controllable all stages of the matrix, and well ahead of its time. What the M2 lacked was the ability to script and automate presets.⁶

⁵And these hurdles are primarily logistical in that so few spaces exist that can be used extensively for diffusion practice and rehearsal. Moreover, constructed systems are never the same, especially when the venues are idiosyncratic.

⁶The normal way of working the M2 is to set ‘hard’ links at the matrix points and automate the input and output faders. When working with a variety of channel configurations (stereo, 8 channel, 5.1) for a recent series of concerts, I realised
For triggering, the Qlist object in MSP and PureData addressing polyphonic soundfile players had already been used in *Fields of Darkness and Light*. The script was relatively simple but I still had to work out the duration of each file. The PureData Qlist below shows voice allocation (which is cyclic here and manually assigned), filename, duration, amplitude and fadeout.

```
5 playme 1 c9.wav 21207 1.0 10;
5 playme 2 c10.wav 21150 1.0 10;
5 playme 3 c11.wav 21287 1.0 10;
5 playme 4 c12.wav 18394 1.0 10;
```

What we require is the ability to create and annotate a live score to control a simple DAW with multiple outputs. James Mooney and David Moore (2007; 2006) have taken the ideas of M2 further with the Resound project (Mooney and Moore, 2008; Moore, 2007). They elegantly articulate a framework of abstraction layers including *Coherent Audio Stream Sets* and *Coherent Loudspeaker Sets*. After Resound, Moore and Mooney created RsoundNV (Moore and Mooney, 2008) which affords much greater access to and labelling of parameters using xml to itemize all aspects of input, output, control and effects. The example below lists a basic stereo definition.

```xml
<!-- A simple stereo pair example -->
<resound>
  <behaviour class="diskstream" id="streamA" source="testfileL.wav"/>
  <behaviour class="diskstream" id="streamB" source="testfileR.wav"/>

  <set id="source">
    <alias id="L" ref="streamA.0"/>
    <alias id="R" ref="streamB.0"/>
  </set>

  <loudspeaker id="G1" type="Genelec 1029" port="system:playback.1" x="-1" y="0.0" z="2" gain="1.0"/>
  <loudspeaker id="G2" type="Genelec 1029" port="system:playback.2" x="1" y="0.0" z="2" gain="1.0"/>

  <set id="mains">
    <alias id="L" ref="bus.G1"/>
    <alias id="R" ref="bus.G2"/>
  </set>

  <behaviour class="att" id="b1">
    <routeset>
      <route from="source" to="mains"/>
    </routeset>
    <param id="level" address="/fader1" value="1.0"/>
  </behaviour>
</resound>
```

that I could create group faders that acted dynamically on each matrix connection and set levels proportionately. This was computationally much more expensive but seemed to work even on a relatively old PC.
ResoundNV works with Jack and Ladspa plugins so the additional functionality of the fractured system is readily available. In rehearsal the interpretor would have the equivalent of figure 9 and a graphic indicating trigger position.

Supposing an eight channel rig as in figure 4 the simplest version would be for the composer to have pre-extended the close of the fracture of MT1 at MT4 and then all the cues be triggered sequentially to all eight loudspeakers. Performance would be a matter of making sure MT2 to MT4 came in appropriately.

A more complex version would potentially divide triggers across multiple matrix points enabling segregation of materials and a comparison between fixed and free spatialisation (there are numerous examples of a 2 + 6 relationship where two channels are mapped to all outputs for diffusion and six channels are hard wired special effects). At MT3 we have a diffusion polyphony and at MT4 the granulation and an extended pause can be sustained on one input fader. There is a potential risk here in that the granulation sample may not be quite what the interpretor (nor composer) was expecting. If the risk is not acceptable, the previous solution (composed extension with manual fade out) may be preferable.

Figure 10: Layered texture simple triggers - almost fixed
Figure 11: Layered texture complex performance

4 Concluding remarks

4.1 Freedom of control, composition v. performance, usable tool or personal project?

As has been shown by the proliferation of electroacoustic music throughout the last thirty years, the forms, controllers and performance practices are as varied as the music being presented. This research will neither replace nor necessarily advance any one particular method but serves to enrich the solid practice of sound diffusion of stereo fixed media.

Past experience at SARC (Queen’s University, Belfast) showed that sound diffusion merging live performance and pre-composed spatialisation (recorded into Pro-Tools during rehearsal) made for a more challenging and exciting performance. I think we can take this further by creating something that sits between the fixed stereo diffused and the fixed multi-channel not diffused.

The ResoundNV is a fully functional programme. The playback engine is modelled and the design is well under way for a robust self-standing piece of software that hooks into ResoundNV via Jack. All that remains is to verify the compositional rationale practically. I hope this paper has set forward theoretical grounds to do just that.

The fact that sound diffusion of fixed media has remained so prevalent is in the simplicity of expansion from stereo to multiple loudspeakers, the fixed and therefore extremely portable nature of the media and the relative simplicity of creating a sound diffusion system. Whilst postulating a whole tranche of possibilities I fully understand that many of these ‘actions’ merge composition and performance. I am keen for this research not to stray too far from solid traditions of composition and performance, and I
certainly do not wish to dictate any particular compositional method. However, it would be nice for this not just to be a personal project. Hence the need to keep this flexible and open so that I and potentially a few others might develop this musically.

References


Discography