IN FLUX – A NEW APPROACH TO SOUND DIFFUSION PERFORMANCE PRACTICE FOR FIXED MEDIA MUSIC

David Berezan
NOVARS Research Centre,
University of Manchester
david.berezan@manchester.ac.uk

ABSTRACT
This paper presents continued research into a new live-acousmatic music composition methodology and sound diffusion performance practice (first findings presented at the EMS Conference, Leicester, 2007). A primary aim is to investigate correlations between enacted spatial distribution or trajectory of sound and introduced variability in timbre, structuring processes and temporal parameters in fixed media music. The concern for sound exploration and timbral articulation is extended from the creation and collection of sound source, through to the manipulation and transformation of materials, to structuring process and performance. In doing so, a greater degree of variability in timbre, morphology, time and structure is introduced through a new performance practice in addition, and in relation, to variability of spatial articulation in sound diffusion. Research has been enabled by the development of a MaxMSP-based environment (FLUX). The interconnectedness of performance practice and compositional strategies, methodologies and materials is also considered.

1. INTRODUCTION
This research supports my work as an acousmatic composer, and as a practitioner and researcher of sound diffusion performance (or interpretation) practice. It is an investigation into live-acousmatic music, where material, while still composed to a fixed medium, is less "fixed" in presentation and performance. For me, the most effective means to accomplish this was to further develop sound diffusion practice, since any traditional diffusion, by its nature, un-fixes work through variation in amplitude, loudspeaker and room acoustic. Throughout, I am concerned with the enacted sound diffusion of stereo or multi-channel fixed-media music in real-time concert performance (using a control interface of some kind, but not necessarily faders).

2. AIMS
There are three primary aims to the research:

1. To create a sound diffusion performance system that cultivates meaningful and dynamic 2-way relationships between the decisions made in sound diffusion performance and the parameters of a work driving those decisions. The system allows selected aspects of the enacted diffusion to further articulate the materials that have influenced those decisions. Commonly, sound diffusion is an interpretation of a work’s internally composed spaces, textural and gestural shapes, spectral occupancy, and structuring processes carried out through spatial articulation within the performance space. The FLUX system can further clarify, emphasise or extend those connections. In other words, "how" a fixed-media work is diffused can deliver a unique realization of the piece beyond its spatial articulation.

2. To find a middle ground between the fixedness of acousmatic music, and live/improvised electroacoustic music, using live sound diffusion as a starting point (what I call “live-acousmatic” music and what Adrian Moore refers to as a “fracturing” of the acousmatic [2]. This is distinct from Denis Smalley’s use of the term to designate mixed and live electronic works [3]).

3. To explore the inter-relatedness of fixed media music composition and performance, preserving the carefully pre-composed element, but extending the performance practice in meaningful ways with respect to the spectro- and spatio-morphologies of a work. This research throws new light on, and weight behind, Jonty Harrison’s assertion that the diffusion of a work is, possibly, the final stage of the bottom-up process of composition in electroacoustic music [1].

There are historical precedents. BEAST (Birmingham, UK) has continuously developed and updated sound diffusion systems, techniques and practice; Sheffield University has developed computer-based sound diffusion tools and live-acousmatic methodologies; and the sound diffusion tools developed at IMEB (Bourges, France) engage with timbral-based distributions within a diffusion environment. The FLUX System extends these procedures to other parameters using a profoundly different approach.

3. APPLICATION
An overview of the MaxMSP-based system reveals that:

1. The composition is played from a dynamically accessible RAM buffer
2. It is diffused either by using the FLUX System’s own computer-based sound diffusion environment with an OSC or MIDI control interface, or by using any external diffusion system (computer-based, analog desk, etc)

3. The enacted diffusion is analyzed and translated back into the fluctuation (introduced variation of timbre, time or form) of the playback of the work, while it is transmitted onto the loudspeakers in the diffusion space.

5. The system is not interface-dependent. It is not limited to faders – the analysis of the enacted diffusion is based upon the measurement of audio amplitude, not control, data.

2. In addition to functioning in a stand-alone configuration, it is adaptable as a front-end for other diffusion systems/configurations, and can be readily disseminated. The system is entirely MaxMSP-based.

3. It is adaptable to multi-channel works. Although primarily created for the performance of stereo works, the system can be configured for works of up to 8-channels, as well as combined diffusion and automation works (ie. 2 + 6 configurations).

4. The system demonstrates low latency and high stability.

5. FLUX

The system’s core component consists of the analysis of the enacted diffusion, the configuration and mapping of the analysis data onto fluctuations, the fluctuation of the material played back from the buffer, and the delivery of the spatialised and fluctuated work onto the diffusion space loudspeakers.

The system enables the diffusion of work onto a maximum number of 48 outputs/loudspeakers, using any multi-channel audio interface(s) compatible with MaxMSP. MIDI or OSC controller data is mapped internally to attenuate amplitude in each output channel. Alternatively, an external sound diffusion system can be used. In this instance, the FLUX system sends the audio played back from buffer directly to the external diffusion system and the outputs of the external diffusion system are plugged into the inputs of the FLUX system.

5.1 Analysis

A primary challenge in the research was to develop a means to analyse enacted diffusion. Measurement of controller data (ie. fader movement), while a potentially viable solution for computer-based diffusion systems like MANTIS which use high-end OSC-based controller fader interfaces, was avoided. The underlying system architecture is intended to be adaptable to diffusion tools as diverse as faders, joysticks, motion capture systems, and traditional analogue diffusion desks. In order to achieve maximum adaptability it is accordingly based upon the measurement of the amplitude of audio (using avg~ in the MaxMSP-based system) that is being sent to each loudspeaker (as determined by the enacted diffusion, whatever its means may be). A further decision was to not measure the level of enacted amplitude relative to the original source level as this limited the system’s effectiveness in multi-channel work, where there is often less enacted diffusion in performance.

The analysis determines how the material is distributed in space (ie. discrete enacted spatial occupancy in up to 48 loudspeakers). It also measures the average degree of amplitude in separate groups of 8 loudspeakers; the overall spatial x-y-z weightings (left/right, high/low, front/back) of the enacted diffusion; and the degree of dynamic amplitude variation (or trajectory) within and between groups of 8 loudspeakers (calculated by the comparison of measured enacted amplitude levels with original source material levels, and

Figure 1. Flux System Overview

The system can be used to diffuse both existing fixed media works and works composed specifically to address the system capabilities. It is fairly widely accepted that acousmatic works vary in their suitability to the application of diffusion practice. This could be even more so of an issue with the FLUX system, depending on how it is used (it could be used with great subtlety, diffusing with only a trace of fluctuation). Implications can arise for the choice of sound materials and related compositional decision-making (works could be composed that are guided by the same strategies that inform their performance using the system). This is discussed later with respect to my own work.

4. IMPLEMENTATION CRITERIA

Several criteria that have been met in order for the system to be considered a viable performance tool.

1. The sonic integrity of the pre-composed work is maintained/honoured. This immediately reveals a contradiction – by its very nature the system can “meddle” with material. It is, however, an extension of diffusion practice. It stresses the need for the mechanisms of the system itself (ie. the means of analysis and playback) to not degrade the original material, and for the introduced fluctuations to integrate as seamlessly as possible.

2. The system is not interface-dependent. It is not limited to faders – the analysis of the enacted diffusion is based upon the measurement of audio amplitude, not control, data.

6. The outcomes of the performance system must be perceptually meaningful. The fluctuations should make sense with respect to the diffusion, and feel less “imposed”.

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determination of the rates of variation in those comparisons. The last, in effect, represents the spatial energy enacted within targeted groups of 8 loudspeakers.

All of the analysis data is available as a continuously updated stream, and as set threshold mechanisms. The data (amplitude level, dynamic, weighting) can be mapped onto selected fluctuation processes, and can vary these processes in real-time.

In the case of multi-channel works, the system architecture allows for a degree of "self-actuation" of the fluctuation processes, as spatialisation information already represented in the material will be measured by the amplitude analysis routines.

5.2 Fluctuation

Fluctuations are introduced into the sound material either locally (at individual or groups of loudspeakers) or globally (at the point of buffer playback). All fluctuation parameters can be mapped onto selected diffusion analysis data, creating dynamic relationships between diffusion and process.

Local fluctuations result in timbral articulation (through equalization/filtering) and density build-up (through delay, layering, transposition and offset of material). Global fluctuations affect the overall pitch of playback (time-varied transposition), material grain (granulation, splintering, freezing), temporal flow (time-stretching) and formal and structural processes: "capturing" material and re-playing (layering), or interrupting the normal play of a work, whereby material can correspondingly be repeated, varied and montaged based upon particular diffusion conditions.

6. TECHNIQUE AND PRACTICE

How might all of this be applied, performed and experienced in concert diffusion? System configuration and application is the key. The system might be configured so that a specified level of dynamic variation (trajectory) within a chosen group of channels introduces increased grain fluctuation (and/or other fluctuations) in the sound material. Alternatively (and simultaneously if desired), as a diffusion interpretation is increasingly "high" oriented in space, the pitch of the material might rise (or fall) in response.

A particular composed textural motion might lead the performer to make a corresponding increasingly active spatial trajectory. This in turn can introduce a fluctuation of timbral colouring (EQ). Consequently, depending upon how it is diffused, further articulation/accenutation of the textural motion/process can be introduced.

In another instance, the weight or density of a gestural event might be increased: I introduce a *sfz* spatial articulation in loudspeakers 1 and 2 in response to the event I hear in the composed work, not only increasing the enacted amplitude, but increasing the density through delay and transposition layering, as the amplitude in these loudspeakers reaches a set threshold and introduces a configured density fluctuation.

Addressing the vertical framing of a diffusion space, a high frequency band might be extended or reinforced (through EQ) under certain diffusion conditions (for example, when diffusing onto loudspeakers that are placed at higher elevations). The system also analyses the horizontal and depth planes, allowing for 3-dimensional timbral tweaking in concert diffusion.

Structural and formal fluctuation can also be affected. Amplitude or trajectory dynamic thresholds set and met in selected channels can select, re-play, layer and vary previous (or future) structures of material (in real-time, during a diffusion performance, though there is the option to manually configure selections in advance so that selections are more precisely specified).

Another temporal fluctuation is more immediately and viscerally affected through the application of granular and pitch-varying processes. This, in effect, allows the interpreter to "grab" material spatially, and freeze, hold, vary and explore it with additional fluctuation until "releasing" it and returning to the normal flow of time.

User application and configuration of the FLUX system largely determines its effectiveness and how perceptually meaningful the fluctuation of material is.
relative to the enacted diffusion. This is dependent upon the nature of the piece, performer or interpreter intentions, personal taste and, naturally, rehearsal and practice time. Application can range from the subtle, to the complex and creative, and to the extreme. Configuration so that given analysis data is mapped onto multiple fluctuations can be quite effective [ie. mapping freeze and pitch fluctuation in close relation], as can mapping the analysis data from one pair or group of loudspeakers onto the fluctuations introduced onto another [creating, in effect, a spatial shadowing, reflection or afterimage]. Selected spatial areas or activity can be used as targets to introduce fluctuation: selected loudspeakers used to “punch” articulations can introduce increased density of material to further emphasise gestural moments.

7. COMPOSITION

Work on the FLUX system has provoked a decision to explore certain types of sound material in my own recent compositional work (Hoodoos, 2007). Recordings and transformations of river ice fracturing and shattering, snow and ice melting, forest materials in motion and burning, and flowing water sounds are incorporated. The qualities of these materials suggest contrasting states of kinesis, fluctuation, fluidity and stasis. This is intentional – reflecting the nature of the non-fixed nature of the research. Structuring processes similarly reflect this.

An important aim of the research was to determine how more broadly composition might be influenced by the capabilities of the system. What pieces and materials will work well with the system? The answer is a simple one: pieces that lend themselves well to enacted sound diffusion (with clear articulation of internal composed space, spectral occupancy, and textural and gestural shapes, processes and motions). The system was created to strengthen those internal dimensions of a work that drive the enacted spatial ones.

8. IMPLICATIONS AND CONCLUSIONS

Each given diffusion interpretation can create a very unique realization of a piece (re-shaping might be extremely subtle, or bordering on re-composition, depending on intent). However, because a given configuration of the system establishes conditions and results that rely upon specific enacted diffusion conditions, it creates sets of concerns, tensions and strategies that differ from those prevailing in traditional diffusion practice. Performance strategies are very important – a FLUX performer begins to consider loudspeakers as targets, zones and tools in the fluctuation of material, in addition to sound diffusion space. It is a new instrument for which a unique performance practice needs to be applied. For me, there is a balance struck between diffusing to "diffuse", and diffusing to "Flux".

The risks are clear. Like traditional diffusion practice, there is the chance that a FLUX diffusion interpretation that is not well-planned, or that is executed poorly, will work against a piece. However, all performance practice carries huge risk of error or misinterpretation. A FLUX-based diffusion requires practice, fluency and configuration and rehearsal time.

FLUX has successfully been utilised within diverse conditions and system configurations including Manchester (MANTIS), Edinburgh (Soundings) and Brussels, and has served as a stimulating focal point for research seminars and workshops at the NOVARS Research Centre at the University of Manchester. In use, the system has proven to be stable and effective. Despite the myriad issues arising from the decision to not base the diffusion analysis upon controller data, I have, ironically, primarily used controller faders for diffusion enaction with the system. This, however, is simply due to my preference for faders. Others may choose other implementations. A planned revision of the system will further the refine the configuration environment, and streamline the overall fluctuations design.

The inaugural implementation of the FLUX system took place at the MANTIS NOVARS Launch Festival for the opening of the University of Manchester’s new electroacoustic studios, 2 November 2007. The FLUX software and accompanying documentation is available for download at the NOVARS website: www.manchester.ac.uk/novars.

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10. REFERENCES


