Embracing Multiplicity: Harnessing Performers' Perceptions to Instigate Emergent Forms

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A thesis submitted to the University of Huddersfield in partial fulfilment of the requirements for the degree of Master of the Arts by Research.

September 2016

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Word Count (Footnotes Included): 12,228

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Acknowledgements

I would like to begin by thanking the University of Huddersfield, which enabled me to study this degree through the Vice-Chancellor's Scholarship programme. I am hugely grateful to this invaluable initiative that allowed me to continue my studies at Huddersfield. I would also like to thank my supervisor Dr Mary Bellamy, for her outstanding knowledge, support and guidance. Likewise the support of my friends and colleagues has been essential throughout this research project; particularly both John Aulich and John Wells have donated their time and patience to sit and listen to my ramblings about this project, and have each in their own ways provided support and insightful guidance. I am forever in debt to the performers I have worked with, Mieko Kanno, Christine Avis and the edges ensemble; their dedication and skill has resulted in some truly wonderful performances over the past year. I would also like to thank both Matthew Sergeant and Timothy McCormack for sending me excerpts of their work, which has been of great importance to my own research. Finally, I would like to thank Kamil Bień and my family for their support, encouragement and love over the past year, without which it would have been impossible to undertake this work.

Abstract

Notions of multiplicity have become an ever increasing part of my compositional approach, both theoretically and practically. This thesis seeks to set out how my music has come to embrace ideas of multiplicity, and what that means for my music from a theoretical standpoint. The music employs modular forms (which are defined in relation to the work of James Saunders and Matthew Sergeant) that allow performers to create their own versions of a piece, through their understanding of material identity. The implications of this process on the composer/score/performer relationship are profound, indeed one can see the forms that each version of a piece takes as emergent. Each version of a piece emerges from the dialogue and mediation implicit in this kind of composer/score/performer relationship. The emergent form of the piece is thus a realisation of just one of the multiplicity of potential versions of the piece there are. I also seek to characterise this composer/score/performer relationship in relation to Bakhtinian dialogism, Sergeant's notions of hybridity and McCormack's theory of mediation. Each of these theories have been applied retrospectively to the works within the folio, these resultant axioms provide new insights into this composer/score/performer relationship, which have informed further investigations.

1.0: Introduction

My approach to music-making has long been entwined with ideas of identity; the elusive, non-representational art of music[1] often seems to me to defy concrete ways of defining and identifying it. Of course, our cultural contingencies mean that we do have a culturally-common understanding of some music (Metzer, 2003, p2), but other than these learnt ways of thinking, how do we identify music? In other words: What am I listening to and how does it relate to everything around it? Time and time again, I have come to the conclusion that such a question is as much about the listener, as it is about the music itself, where our own cultural-contingencies and personal histories come together to form our *individual* perception of the music, from a multiplicity of different ways we could have perceived it. Subotnik makes a similar, rather compelling, argument:

> "Only some music strives for autonomy. All music has sound and a style. Only some people listen structurally. Everyone has cultural and emotional responses to music. These characteristics and responses are not uniform or immutable but as diverse, unstable, and open-ended as the multitude of contexts in which music defines itself. And yet, the world of knowledge opened up to us by acknowledging the bases of this indeterminacy as the foundation for our concept of music is far more encompassing than the domain that the supposedly universal principle of structural listening can hope to control without violating or exceeding itself" (Subotnik, 1995, p175).

Peter Ablinger's work *A Letter From Schoenberg* (Ablinger, N.D.) is an interesting example of this kind of situation, where different listeners will have different perceptions of the work. The piece is built out of recorded speech, whose tones and frequencies are then analysed and played on the piano's mechanism (Barrett, 2009, p148). The effect of this process on one's perception is profound; without the text on the screen, it is almost impossible to hear it as text, but just dense clusters of complex piano music. When one reads the text on the screen, the music becomes understandable language, drastically changing the experience (Barrett, 2009, pp160-161). This is a music that cannot be universal; the languages understood by a listener, the moments they spend looking at the text, how well they know the piece, and how well they

[1] Christopher Hasty makes the argument that music in non-representational, see Hasty (2010).

know the text, all add up to create different experiences of the music, not just between listeners, but also between listening's. In this listening process, it is not just the listener hearing the music, but a listener's experience is actively changing their understanding of the music. This is a music that does not just accept that it will be heard in a multiplicity of different ways, but that this notion is a fundamental part of what it is.

I have been seeking to create a music that embraces these notions of multiplicity, by allowing for the enactment of these diverse perceptions by a performer. Particularly, I am interested in a performer making formal decisions within open forms based on notions of material identity (although much of that material is in itself indeterminate and reliant upon the performer), which creates an emergent form. The music can be understood to be emergent where local-level interactions lead to higher-level formal structures, which exhibit some form of macro-behaviour (Johnson, 2001, p19). These structures are the result of local-level interaction between the performer, score and the composer, rather than being imposed on the performer by the composer[2]. The emergent forms are part of a diverse set of potential realisations of each piece, which in themselves, reflect the multiplicity of ways in which music can be understood and reacted to. The music has drastically changed sonically, moving from a highly determinate sound-world dominated by complex pitch and rhythmic material to noisy, physical, cacophonous sound-worlds, whose highly specific yet indeterminate nature contributes to the ensuing multiplicity inherent in the works.

1.1: Approaches to Material Identity: The Enactment of Perceptions

The open forms in all of the pieces within the folio require the performer to enact decisions regarding their perception of material identity. I would like to begin by looking at Sergeant's definition of material identity, in relation to his work on hybridity, before coming to define the term in relation to my own work. Sergeant makes the case that material identity is a coalescence of the parameters heard, he argues:

> "The material identity of the sonic surface is experienced holistically through time. As such, in the ear of the listener there is no bifurcation between different compositional

[2] Although it is worth noting that the performative situation is imposed upon the performer by the composer.

> levels; instead the facets by which it is heard define the material identity. Any notion of inconsistency within the sonic surface as heard becomes an experienced behavioural consistency" (Sergeant, 2013, p130).

It seems important to understand not just that the material identity is a coalescence of parameters, but an experiential phenomenon ("[…] becomes an experienced behavioural consistency." (Sergeant, 2013, p130)). The idea of experience introduces a variance in exactly how such a definition might be understood perceptually. As Christopher Hasty argues:

> "The order placed in "the notes" by the composer can seem to constitute the ideal and changeless truth of the composition regardless of whether this order in its necessary singularity and purity is or even can be experienced by another individual" (Hasty, 2010, p3).

For Hasty and others, the idea of an objective musical experience is false; experiencing music or indeed experiencing musical behaviour, is not a singular perception, which can be defined for a whole audience, but a highly personal process based on one's own personal histories (Cook, 2000, pp76 -77; Hasty, 2010, pp3 - 4; Subotnik, 1995, p175)[3]. My own approach to material identity can now be more clearly defined; it is a personal experience of the coalescence of parameters, which creates an experienced (or personal) consistency that is a material identity. An identity based not just on what we are hearing, but how we understand and perceive such a hearing, in relation to our own cultural contingencies.

It is this thinking that has resulted in a music that is highly open in its approach to material identity. A music that is dictated by perceptions of a music's material identity, rather than an analytical or parametric breakdown of what is to be played. A performer instigating their own perceptions of material identity creates a highly interesting performative situation, which is not open, nor closed, but dialogic and mediatory[4]. A performer having some freedom to bring their own perspectives to the music creates a music that is in itself a hybrid of my thinking and a performers thinking. It allows not just for a multiplicity of ways of thinking and perceiving the music, but also a multiplicity of different versions of the music, based on their perceptions.

[3] To be clear such comments are not an attempt to falsify Sergeant's theory; but an expansion of it into my own framework.
[4] The terms dialogism and mediation will be outlined further in sections 3.1, 4.4 and 5.0.

1.2: Closed Modular Forms: A Relational Approach to Form and Structure

The scores for each piece within the folio are not presented to the performer as a finalised score, but as a set of potentialities that can be realised within a framework (based on notions of material identity) to create a final score; in many ways, these could be described as modular forms. Throughout this process, I have experimented with various types of modular forms that allow a performer to move to different modules within the piece. There are many reasons for the use of a modular system in any product (and indeed in music), my particular incentive for the use of such systems is the flexibility they can bring. Sanchez makes the argument that modular systems have:

> "The strategic flexibility to configure a broad range of product models, including many regional product variations, while also achieving low production costs globally through the mass production of common component sets used in all models" (Sanchez, 2004, p60).

Whilst the financial elements of Sanchez's statement might not be so useful from a compositional point of view, the idea of a highly flexible composition which enables a multiplicity of different versions of a singular piece is something that is of great importance to my work. The use of modular systems has been a key element of James Saunders' work *#[unassigned]*; work I have often used to help define my own modular systems. His research points to two significant types of modular forms, both of which are defined by the kind of interface[5] they employ; closed and open modular forms. Saunders makes the argument that closed modular forms have a limiting interface:

> "There are two principal criteria which indicate that a structure is closed. Firstly, there needs to be a limiting interface which restricts the ways in which modules can be joined within the rules of the system" (Saunders, 2008, p156).

[5] Here I am defining interface as the way in which two modules may connect, as Saunders does (Saunders, 2008, p155; Saunders, 2003, p57).

Saunders goes on to argue that to be closed, the modular form must also have a limited number of modules, otherwise, the potential to create an object (or piece) that has an unlimited amount of versions is possible (Saunders, 2008, 157; Saunders, 2003, pp58 - 63). Conversely, open modular structures have the potential to be unlimited in their form; to do this they have to fulfil one of two requirements. The first is that there is no strict interface which connects the modules, rather any module may interface with any other. Alternatively, an open modular form can be created by having an unlimited number of modules; if there is no limit to the number of modules that can be created for an object, then there is no limit to what that object could become (Saunders, 2008, p158).

Open and closed approaches to modularity both have their own strengths and weaknesses, but throughout this folio I have tended towards closed modular forms. One of my significant concerns throughout this process is that of "quality control", although a slightly clinical term, it is one of the problems that comes with music that tends towards openness. Indeed, Saunders does suggest the possibility of the approach I am taking with regards to modular composition, where the performer, rather than composer, puts the modules in any given form. He comments:

> "Anybody could potentially make and play versions of *#[unassigned]*, removing the current quality control my involvement provides (it is, after all, my piece). There are two principal advantages. It could create some very interesting structures, as people use the material in ways I had not anticipated (it becomes a tool)" (Saunders, 2003, p94).

Saunders' comments upon the quality control problem with *#[unassaigned*] resonate with my thinking[6]. If he were to cease assembling the pieces and allow versions that were not crafted by him to proliferate, then versions that are of a low quality (at least by his own standards) could be created. *#[unassaigned*] is an open modular piece (Saunders, 2003, p89), which gives it a much larger scope for these kinds of problems to arise. If it were a closed modular piece, in which new modules could not be added and a limited interface were introduced, then the likelihood of such an issue occurring can be significantly reduced. Employing closed

[6] Although Saunders is commenting on a situation where a performer also makes the modules themselves, it highlights a more general problem in regard to open modular forms and notions of quality control, particularly since Saunders does assemble the modules himself.

modularity can introduce some quality control measures, whilst also enabling a performer to choose between modules.

1.2.1: *bet denagel* and hybridity

Matthew Sergeant's *bet denagel* is an interesting example of closed modularity, where the performer has the freedom to move between modules in the performance situation. The "tube map" shown in figure 1a (its legend is shown in figure 1b), shows the modular structure in *bet denagel,* and crucially how it relates to the hybrids that it is created from. There are two distinct features to Sergeant's approach that are equally fascinating.

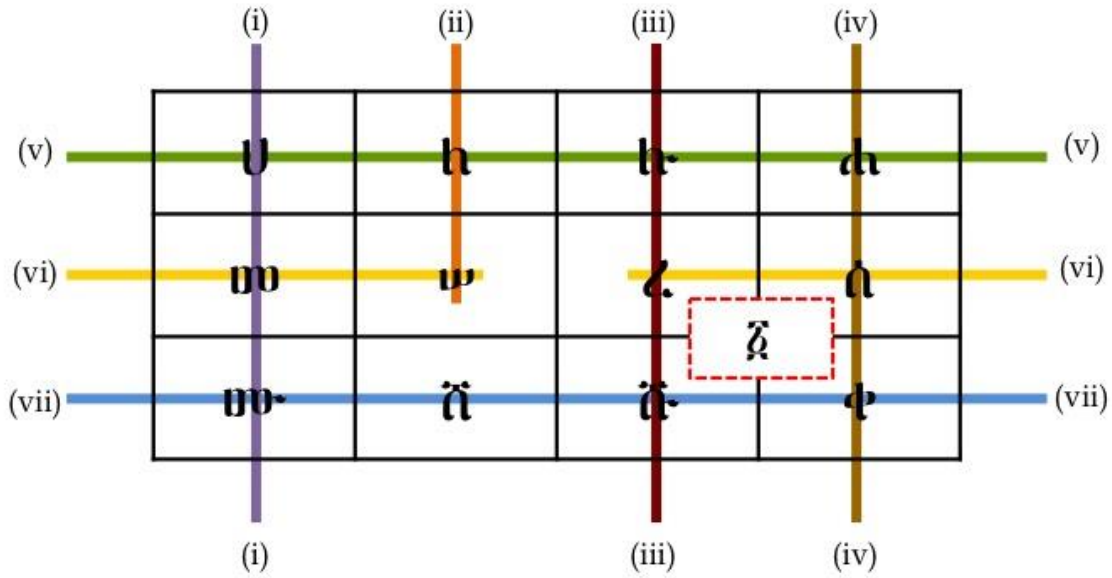

Figure 1a. The modular structure of *bet denagel* (Sergeant, 2013, p113)

Path	Colour	Comportment		Enclosed Districts
		Trope	Type	
(i)		Bow-pressure: "dynamics"	Timbral	ሀ , ጠ , ጡ
(ii)		Bow-space		ከ , ሠ , ኘ
(iii)		Bow-position		ኩ , ረ , ኙ
(iv)		Bow-material		ሐ , ሰ , ቀ
(v)		Acceleration/deceleration	Tempo	ሀ , ከ , ኩ , ሐ
(vi)		Stable		ጠ , ሠ , ረ , ሰ
(vii)		Terraced tempo changes		ጡ , ኘ , ኙ , ሐ

Figure 1b. Legend of Paths for *bet denagel* (Sergeant, 2013, p118)

The first is the way in which the modules are structured in relation to their hybrid elements, as with many recent Sergeant works, hybridity is at the core of the piece, where multiple behaviours are superimposed upon each other to create hybrid materials (Sergeant, 2013). In *bet dengel* this approach is coupled directly with the use of modular forms, the structure shown in figures 1a and 1b is the modular structure of *bet denagel*. Each coloured line represents a behaviour in either the bow or tempo and where they meet a hybrid module is created (Sergeant, 2013, pp117 -118). This combination of hybridity and modular forms is something that has come to interest me greatly. Here the modular interface is based upon elements within a hybrid, and the structure of the modules and their material identity become entwined.

Secondly, the modular form requires a performer to move from module to module, making these decisions during the performance, creating a structural indeterminacy with the potential to create an array of different structures (Sergeant, 2013, pp113-114). The composer allowing the performer to move through this closed network during the performance creates an incredibly interesting situation, but importantly it does not present the kind of problems that Saunders anticipated could arise in his open modular forms. Closed modularity seems to have provided this piece with a very specific way of structuring it that is still (somewhat) open.

The use of hybridity as an interface for this modular structure ensures there is some form of relationship between each module,[7] whilst also maintaining a degree of openness.

1.3: Speculations on Modularity and Hybridity

By employing hybridity as an interface within a closed modular form it may be possible to create complex open forms that also have a contingent way of dealing with issues of quality control. Not only that, the ability to create a variety of complex relationships between modules is a musically inviting prospect for me; in previous works, I have often composed in a "modular" way, by reordering sections and finding orderings of sections in a piece that I prefer. In this case, the decision is simply transferred to each performer, rather than being a compositional one. Of course, the way in which such a formal network is presented to a performer may be problematic and may vary from piece to piece. Having outlined these two axioms (modularity and material identity) that are central to the folio, I would like to begin to critically reflect upon the pieces within the folio and their development.

[7] One of the reasons Sergeant employed this particular form was to make a listener feel disorientated within the music, allowing the listener to "feel lost *inside* the structure". Sergeant argues that this is achieved because there are relationships between each module, some of these relationships are very obvious, whilst others are not, giving rise to the feeling of disorientation (Sergeant, 2013, pp118-122).

2.0: *Abstrakcya?* Introduction and Aims

Abstrakcya? is the first work within this folio and thus presents an initial attempt at dealing with material identity and open forms within this research context. Much of my formal thinking has been highly influenced by the work of Jorge Luis Borges, particularly *The Garden of the Forking Paths, The Library of Babel* and *A New Refutation on Time* (see Borges, 2000), whose labyrinths of time court paradox and question the ideas of unity and disunity, that have been at the forefront of much of my own compositional work. The piece also uses a form of hybridity in the creation of its materials, which will be discussed in detail. Whilst this piece may differ greatly from the rest of the folio and in many ways be a failed piece, it is nonetheless an incredibly useful piece to have written. Much of the research I have undertaken since writing *Abstrakcya?* is based on observations and critical reflections of this piece, and thus I seek to detail those critical reflections here.

At various points in *Abstrakcya?* there are two staves present, the small upper stave always contains the first three bars of the piece constantly repeating, whilst the lower stave contains new material, which is a distorted version of the first three bars (see figure 2). The performer is asked to play the new material in the lower stave unless they perceive that the identity of this material is significantly different from the original three bars. If a performer feels the new material is no longer in keeping with the original material then they are asked to play the original material in the small upper stave. Using this quasi-modular system I felt a performer could instigate their perceptions of the material, however, as I will detail below, the way in which in the material is distorted is highly problematic within this process.

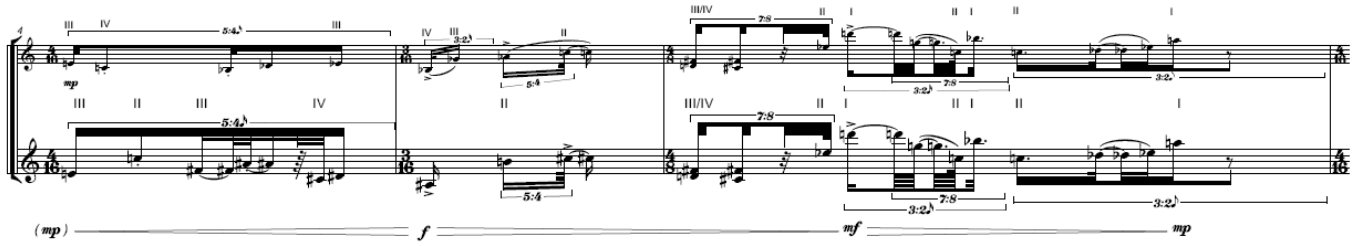

Figure 2. Bars 4 – 6 of *Abstrakcya?*

2.1: Methods of Distortion

Before analysing how effective my methods were in creating hybrid materials that allow for closed modular forms to be enacted through a performers' perceptions, it is imperative I make clear how the materials in *Abstrakcya?* were created and distorted. The distortion process bears some similarity to the work of Brian Ferneyhough, where he combines multiple layers of music to create a "conjoint layer" (Fitch, 2013, p114). *Abstrakcya?* is built out of two strata of materials, which are shown in figures 3A and 3B below.

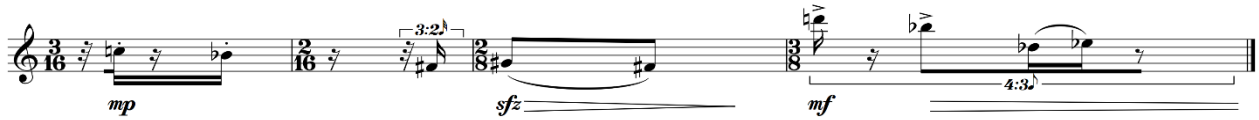

Figure 3A. The changing upper strata of *Abstrakcya?*

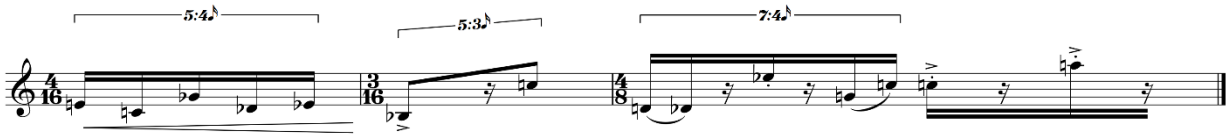

Figure 3B. The repeating lower strata of *Abstrakcya?*

The strata shown in figure 3B (henceforth known as the lower strata) remains the same throughout the duration of the piece. The strata shown in figure 3A (henceforth known as the upper strata) is rhythmically augmented and diminished, per bar. For example, the first bar may be augmented by a factor of 1.16 recurring, the second bar may then be augmented by a factor of 1.25, the third could then be augmented by a factor of 1.5 and finally the fourth and final bar may be diminished by a factor of 2. This would then create a new set of bars in which to shrink and expand the original material, as shown in figure 4.

Bar of Upper Strata	Diminished/Augmented Factors.	Original Length of Bar	New Length of Bar
1	Augmented a factor of 1.16 recurring.	3 Semiquavers.	7 demisemiquavers.
2	Augmented by a factor of 1.25.	2 Semiquavers.	5 demisemiquavers.
3	Augmented by a factor of 1.5.	2 quavers.	3 quavers.
4	Diminished by a factor of 2.	3 quavers.	3 semiquavers.

Figure 4. The process by which the upper strata was augmented and diminished

Once the original material was rhythmically augmented or diminished into these bars, the ratio by which these bars are augmented and diminished is then multiplied or divided by the frequencies of the pitches present within each bar. The new frequencies are then 'quantized' to the nearest quarter tone and thus the new material is made. Figure 5 shows the new material that this distortion process made. This process was then repeated with different bar lengths, until I felt there was enough variety in the new material to allow for very differing views on what constituted this materials identity.

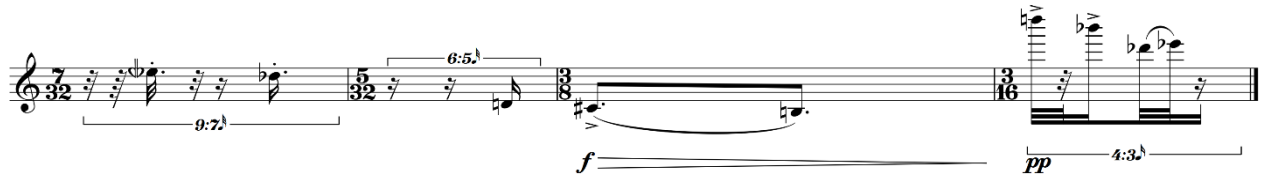

Figure 5. The result of the rhythmic and pitch distortion

The next process to take place is the hybridisation of the new material (generated using the process aforementioned) and the original material. The new material in the upper strata is combined with the repeating material in the lower strata, as can be seen in Figure 6. At this stage, various decisions are made as to which parts of which strata should be prioritised, in order to avoid inevitable idiomatic impossibilities.

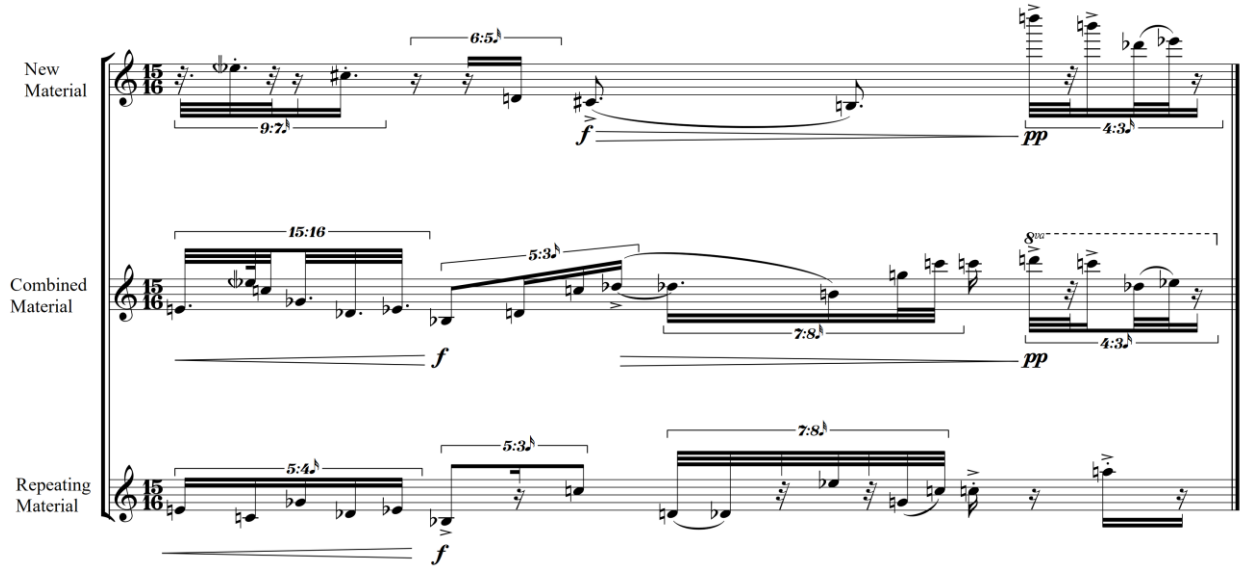

Figure 6. A sketch of the combining of the two strata in *Abstrakcya?*

The process outlined here has been used to create all of the new material within *Abstrakcya?*, as one might see from the example above, there are places where I have felt the need to stretch or bend my own rules. At times I have even done things inaccurately, both for the sake of idiomaticity and to stay within the limitations of this rather traditional notation. I do accept these inaccuracies as part of the distortion process, so the limitations of traditional notation in themselves, thus become modes of distortion.

2.2: Results of the Distortion

Having heard the results of this process, it seems clear to me that the process does not go far enough. Particularly, the material itself rarely changes significantly; issues of texture, density, rhythm and harmony all contribute to this. Through understanding the problems with the material and its construction, I hope to gain an insight into the kinds of materials that may be more appropriate for future endeavours.

The density and texture of the piece are particularly problematic, since they rarely seem to change; of course, this is the product of the process by which the material was created. The lower strata (figure 3B) repeats throughout the piece, which means that despite having new material superimposed upon it, there is a minimum density present throughout the entire

piece. Even if there were an incredibly sparse area in the new material, its superimposition upon the repeating lower strata means that the rhythmic and textural content remains irrefutably dense throughout the piece, because of the density of the lower strata itself. The result is a density that is self-similar throughout the piece, and if one were judging the material on its texture and density alone, then it is doubtful that any significant differentiation would occur.

Indeed, one can see both the harmonic and rhythmic language of the piece (which form the core of this pieces sound-world) as highly self-similar. The harmonic language is always rooted in the harmony of the lower strata, and whilst new pitches present themselves above those of the lower strata, they rarely feel alien enough to the language of the lower strata to destabilise the harmony of the piece. The rhythmic language is highly unstable, with a large amount of "irregular" tuplets, but it remains within a self-similar language, and yet again much of the rhythmic language was informed by the constantly repeating rhythms in the lower strata.

The sonic surface of the music does not seem to really change but becomes a variation of itself. Here then lies the major problem that has faced *Abstrakcya?* thus far. The piece does not achieve the performance situation that I was seeking to create, if the material does not really change, then the form is simply ineffective, because a performer's perception will always be skewed toward the "new" material. Such self-similarity in the materials construction acts to undermine, rather than embrace, the potential multiplicity inherent in *Abstrakcya?'s* form. The two sets of material from which the whole piece is built (figures 3A and 3B) are also self-similar in style and language. The two examples do not have a definitive gestural identity but are much more loosely defined, with similar characteristics. Beginning with a set of simple, easily definable divergent gestures, may make it easier to create interesting and effective hybrids.

2.3: A Borgesian Form?

The idea of multiplicity is at the heart of *Abstrakcya?'s* form, there are over 90,000 different possible ways of working through the score. Much of this notion of multiplicity is inherent in the work of Jorge Luis Borges, whose short stories have fascinated me; *The Garden of the Forking Paths* has often informed my creative thinking with notions of multiplicity. The

paradoxical timelines, completist libraries, and infinite futures of Borges' work have instilled notions of unity and disunity in my work. In many ways one can see the works in the folio as characters in Borges' *The Garden of the Forking Paths*; there is only one of them, yet there is also an [in]finite set of variations of them. As such, I seek to frame my use of form in *Abstrakcya?* around some of the central ideas in Borges' narrative, and to retrospectively critique the work in such a light.

Borges' *The Garden of the Forking Paths* presents us with a book which seems at first to be paradoxical, his characters cannot decipher why in one chapter the main character has died, and yet in the next, he is perfectly well. The indecipherability of the text comes down to questions of time, and with Albert's help, Yu Tsun discovers that the book has multiple timelines. A theory in which there are various futures for every possible outcome, and thus there are an infinite amount of possible futures. On the large scale then, there are multiple versions of the same time all in being at once; multiple forking timelines that stem infinitely further (Borges, 2000, pp44-54). It is this notion that I wanted to capture in my work, the multiplicity of the potential (and in some senses) actual versions of oneself. These futures are then brought into being by a performer, who materialises one of them from a multiplicity of potential works, into a final form.

In many ways, *Abstrakcya?* achieves these formal aims. Theoretically, the piece has the potential to create 91,204 versions, which represents a huge multiplicity of paths that a performer might follow. However, a problem is encountered when one realises that many of these versions will be highly self-similar. A major problem with *Abstrakcya?* is that if the performer makes the decision to not play the new material, they are forced to constantly repeat the same three original bars. Essentially, half of the possible routes in the piece are 'play the original material again'. That seems to be a rather odd notion, surely in the future something *should* change, for in Borges' view if it does not we are returning to the past which "break['s] down and confuse['s] the series of time" (Borges, 2000, p259). In future works, ways of easily introducing new material into the open form seems to be highly important, otherwise, the full effect of the potential multiplicity is in many ways masked by the self-similarity of many of the materials. The high levels of repetition in *Abstrakcya?* also seem to contradict the material itself; the material's self-similarity is constantly perpetuating a sense of repetition, exacerbating the already high levels of actual repetition, which ultimately undermines the theoretical success of the form. A performer can indeed choose to move

through the score in a multiplicity of different ways, but the works very materials seem to undermine that multiplicity.

2.4: Lessons from *Abstrakcya?*

Having problematized *Abstrakcya?*, one can begin to draw some conclusions regarding, not just the success of the piece, but also areas in which further investigation is required to achieve my goals. Clearly, the musical material resultant from the process described above does create some form of ambiguity. This results in an ambiguity that is not between the materials, but within the materials themselves; thus creating a form based on decisions of material identity is simply ineffective, when such materials are applied. As I stated earlier, I now think that it is imperative that the materials in any future exploration have a clear identity (at least, in the beginning) to achieve a more meaningful set of material for this kind of formal indeterminacy. One way of creating more clearly defined materials could be to use an array of simple gestures that can be combined in a variety of different ways.

The form of the music is, for the most part, successful, but it has significant musical limitations. Despite there being a multiplicity of over 90,000 variations of the piece, the extreme repetition created in many of these variations is not musically viable, nor interesting. As such, I believe most performers would make a decision similar to that of Mieko Kanno's, in which just new material is played. Whilst this does create a composer/score/performer relationship that is reliant on a performers perceptions, the material itself is so self-similar that it is highly unlikely there will be significant differences between different versions of the piece by different performers. This results in a situation in which a performer enacts their perceptions, but that enactment has very little effect on the multiplicity of potential versions of the piece.

To solve this problem, I would like to introduce an analogy with multicursal mazes. These are mazes, that like Borges' forking paths, split into two and create points of decision (Doob, 1990, pp46-48), this bifurcation allows for the presentation of new material on *both* possible future 'paths'. Using the multicursal model, we can not only create a Borgesian forking path but allow for significant variations in all the new material. It also seems important that there is a large enough pool of differing materials from which to draw, to create not just a theoretical multiplicity, but a musical multiplicity of potentialities for each piece.

Adam Sangster

Spreadsheets and Circles
for 5 or more performers.

Rub an object of your choice against a surface of your own choice in a circular motion. This object/surface combination should be fairly audible, but not loud. Change your circular rubbing motion in response to the instructions on the table below. Choose any instruction to start with, then move through them in a linear motion; either horizontally, diagonally or vertically. Linger on each instruction for some time before moving on to the next. The movement between the instructions may be sudden, or gradual.

When the quality of the sound you are making changes, stop playing. Wait. Listen. If it feels right, then begin again. Once you have stopped playing three times, wait until everyone else has finished.

Wider	Harder	Faster	Harder	Smaller	Smaller	Slower	Faster	Slower	Faster	Softer
Smaller	Softer	Softer	Slower	Harder	Faster	Wider	Smaller	Slower	Slower	Faster
Softer	Faster	Slower	Smaller	Wider	Wider	Faster	Harder	Slower	Harder	Softer
Softer	Faster	Slower	Slower	Wider	Smaller	Faster	Wider	Smaller	Slower	Harder
Slower	Faster	Wider	Harder	Softer	Slower	Faster	Faster	Smaller	Faster	Slower
Faster	Wider	Harder	Faster	Slower	Harder	Softer	Softer	Wider	Wider	Smaller

Figure 7. Score for *Spreadsheets and Circles*

3.0: Towards Notions of Physicality as Open Form: *Spreadsheets and Circles*

Spreadsheets and Circles (2016), composed for the edges ensemble, presents a significant turning point within the folio. Composing for the edges ensemble requires a very different idiom to that of *Abstrakcya?* but the new idiom required for such a piece has led to a large development from a theoretical viewpoint (much of which is a response to the issues that were highlighted in *Abstrakcya?*). Although these ideas will be explored further, I would like to initially outline how my understanding of my aims and ways in which these aims can be achieved has changed.

The first significant change is that the score has moved from descriptive notation to prescriptive notation (the score is shown in figure 7), which employs physicality as a compositional tool. Each instruction is a word which has physical implications for the circular motion the performer continues to make throughout the piece. Rather than having defined sets of material (as one does in *Abstrakcya?*), the material is a result of the manipulation of forces that are being applied to this single circular gesture. As such, one can see the music as employing physicality as a means of manipulating the sound-world; the potential sound-worlds are further diversified through the use of open instrumentation within the piece. If the change in physical force being applied to the instruments changes the resultant sound enough, then a performer is asked to cease playing (although they may start playing again; once they have dropped out three times, they must stop playing completely).

Whilst in some ways quite simple, the process outlined above creates a rather complex performance situation and a piece which has a multiplicity of potential versions. Each performance emerges from the decisions of the performers and how they choose to interact with the score. The instruments they choose, how they play their first circles, the cell that they begin at, the cells in the spreadsheet they move to, and when a performer drops out and re-enters the piece, all effect the resultant outcome. Thus the material for each player emerges from these decisions. The overall sound-world, and indeed the form, emerge[8] from the collection of these decisions from across the ensemble.

[8] The notion of a formal macro-behaviour emerging from these interactions (which is contingent in defining the structure as emergent), seems highly subjective (Davis, 2010, p138), but I would argue that such a macro-behaviour does exist. For me, a clear formal

3.1: Physicality and Mediation

The employment of physicality as a compositional methodology is of key importance to *Spreadsheets and Circles*. By approaching the material as sets of forces (rather than pre-defined notes and rhythms), I am creating an inherent sense of potentiality and multiplicity. The breaking down of the instrument into individual sites of action means that the sites of action and their behaviours can be combined in many different ways to create many divergent sound-worlds. The idea of these forces coming together is particularly resonant with Timothy McCormack's notion of mediation, but they also resonate with Sergeant's work on hybridity. We can see the process of mediation beginning to play an important part in the work, where multiple physical forces act upon each other to create a resultant sound. As McCormack argues:

> "The relationship between forces at work in my music is mediatory when both forces have a mutual ability to influence the other. The sound that results in such a situation is thus a mediated sound as it is issued from the collision and refraction of multiple physical forces" (McCormack, 2010, p12).

One could understand the process of mediation as a process that creates hybrids, the mediated result is contingent on two forces coming together to create a single sound. Indeed, the idea of a collision of forces bears similarity to the way in which Sergeant understands encrustation and erosion, two strategies of hybridity used in his work. As Sergeant argues:

> "By creating equally consistent materials in different planes of physical parameters and then abruptly recombining them in compositional space, the potential is offered where the mutual physical actions of such materials either counteract and erode each other, or entwine and encrust" (Sergeant, 2013, p75).

One of the key terms highlighted by both composers is the idea of a *mutual* collision[9]. It is imperative to understand that the process of mediation and indeed the creation of a hybrid,

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identity is observed emerging from this process, as can be heard in the recording of *Spreadsheets and Cirlces* supplied.

[9] One significant difference between the two composers' methodologies is that McCormack's collision takes place in the performative situation where the performer(s) playing the piece

comes from a mutual disruption of multiple forces/materials, rather than one thing disrupting another whilst remaining entirely unaffected, it is a double-voiced mediation.

Not only can we then see the materials in *Spreadsheets and Circles* as hybrids, but they can also be considered to be the emergent result of a mediation of this kind. Multiple physical forces collide and refract to create the material. The speed of one's hand in completing the rubbing motion, the pressure being applied to the surface of the instrument (or object), and even the width of circle itself come together to create a resultant sound that is the collision and refraction of these forces. As a performer moves through the cells in the spreadsheet, they change one of the forces at work, and thus the relationship between all the forces changes and new sounds emerge. Given that there is a range of possible complex relationships between these forces, there is also a huge range of possible outcomes, and thus this enables one to have a multiplicity of potential material that might emerge from this performance situation. These potential outcomes are further diversified through the use of open instrumentation.

The combination of open instrumentation and the use of physicality as a compositional tool can create highly indeterminate results. James Saunders' comments upon open instrumentation highlight the issue:

> "When a score specifies a fixed instrumentation, it closes off certain sonic possibilities. By writing a piece for flute, for example, the set of possible sounds available is immediately reduced. Whilst it is clear that this does not create a finite sonic resource—there are, after all, an infinite number of subtle variations available to the flautist—it does shape the resultant piece. Alternatively, when a score allows for an open instrumentation—where the choice of instruments is not fixed—the potential for a wider sonic resource becomes apparent" (Saunders, 2013, pp473-474).

activates the collision of these physical forces (McCormack, 2010, pp12-13). On the other hand, Sergeant uses a process of recoupling to combine and collide these forces as a compositional process (Sergeant, 2013, pp73-75). My own approach is thus much closer to McCormack's, although I do derive my pitch content in *Kretan* by combining data I have created for the use of string, finger and hand position on the instrument, thus I partly employ a recoupling strategy.

In my case the choice to use open instrumentation was to allow for a large and unpredictable timbral palette, resulting from a very self-similar gesture, thus the use of a "wider sonic resource" was deemed necessary.

There is not just an indeterminacy in what the instrumentation is, but there is also an indeterminacy in how well the instrumentation will react to the physical changes in the circular gesture that each performer is making. During the rehearsal process, this became apparent very quickly. One performer using a mortar and pestle made little timbral distinction in her sound, but the rhythm of the sound did change significantly. Another performer brushing the fabric of a chair with paper, was able to make a large differentiation in timbre using pressure and speed, creating a highly diverse timbral range. The decision to use open instrumentation creates ambiguities in the potential resultant sound-world and thus in the form; it diversifies the multiplicity of potential versions of this piece.

3.2: Defining Change, Surface and Identity

As I have already ascertained in section 1.0, music is understood in a multiplicity of different ways, often through our own cultural contingencies and personal experiences of music. The form is designed to emerge from a multiplicity of potentialities without any bias; but the text "When the quality of the sound you are making changes, stop playing." in the score for *Spreadsheets and Circles*, has an implicit message that quality of the sound *is* going to change, even though that might not be the case for some performers. Such an instruction indicates that there is a correct and incorrect way of perceiving the piece, which of course contradicts my original statement.

When the performer makes a decision about any change in material identity (which would result in them dropping out from the piece), it needs to reflect their own understanding and perception of what I mean by material identity. This then maximises the multiplicity of the form, where the performer can drop out at any time based on their own understanding of the work, rather than attempting to understand it from my biased point of view. Such a situation creates a united approach to understanding the music within an ensemble, rather than allowing it to be understood in a multiplicity of different ways.

3.3: Emergent Material and Form

Each of the above analyses of *Spreadsheets and Circles*, begin to detail how in every level of the composition notions of multiplicity are at play. There is an emergence of material and form from physical forces and the use of open instrumentation, and even the affordance for the performer to enact their perceptions of the piece[10], rather than through my unified vision of it. Each performer's sound emerges from these decisions; the resultant sound and form is a meta-emergence, from the collection of every performers' decisions and perceptions. In many ways, *Spreadsheets and Circles* seems to be a highly successful piece, but much of the music I am interested in composing requires more a "traditional" approach to notation. For me, it seems imperative to find ways of creating similar kinds of performative situations in "fully notated" works.

[10] As I have already pointed out, the way this is achieved is not truly open because of the performance notes' implication that the material identity *will* change.

4.0: *Kretan* and *Reticulation I*

Kretan and *Reticulation I*, both share similarities in their notational and conceptual approaches, concepts that are responses to the issues and ideas highlighted in previous work, most notably in *Spreadsheets and Circles*. Particularly, both works deal with issues of material indeterminacy through physicality, hybridity and mediation; I will look to the music of Aaron Cassidy and Timothy McCormack in this vein. I will also seek to outline the relationship between form and materials, particularly how the interface in the closed modular form has notions of physicality at its core. Finally, I seek to detail the use of score generation software and its ontological implications for the music and begin to introduce the concept of Bakhtinian dialogism, to critique these works and to introduce areas of future enquiry.

4.1: *Kretan* and *Reticulation I:* Closed Modular Forms with a Hybrid/Physical Interface

Although the forms in both *Kretan* and *Reticulation I* are quite different, the core conceptual elements of such forms remain consistent. A major factor in both forms is the idea of closed modularity (see section 1.3), the construction of these closed modular forms is through a hybrid interface. In both cases the modules are related and connected through some form of hybridity binding them together; one element that makes up the hybrid is always continued across the modules (in a similar vein to Sergeant's *bet denagel*). In both pieces, a performer generates their own score, by making decisions about material identity.

The employment of physicality in this approach is highly contingent within such an interface. As with McCormack's work, *Kretan* and *Reticulation I* use mediation as a means through which the sound is created. In *Kretan*, various sites of action work independently (and are parametrically decoupled) which then "collide and refract", as can be seen in figure 8.

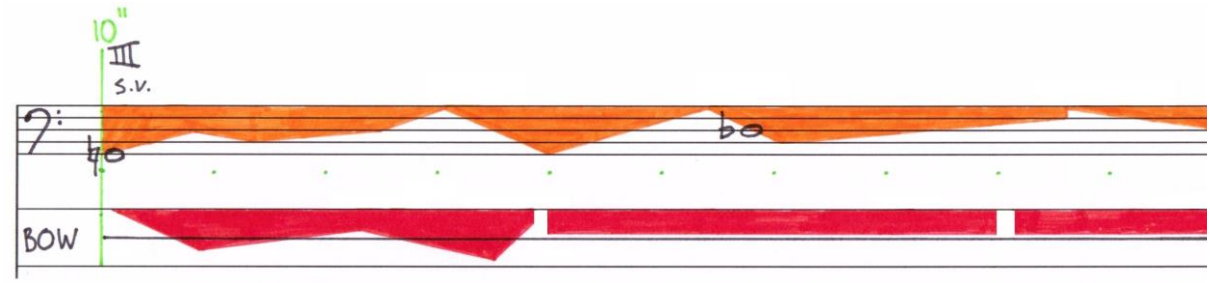

Figure 8. Extract from *Kretan* (module D14)

Here the bow pressure (in red), the finger pressure (in orange), the string, and pitch content, all come together to make a hybrid sound world[11]. The forces of the finger pressure, moving between states of defined pitch and unstable harmonics mediate the pitches and yet the resultant harmonics are also mediated by the position of the finger(s) on the fingerboard (as defined by the pitch content). In turn, they are mediated by the bow pressure, whose initial unstable form quickly normalises into a given pressure. The forces very literally collide giving rise to an array of indeterminate sounds, which emerge from these mutually mediated forces.

The sound-world that mediation induces (particularly in *Kretan*), is one that is characterised by indeterminacy, which is not only unstable from one play through to the next, but also between performers and instruments. [12] This is a situation that Aaron Cassidy highlights is present in much of his recent music[13], as he points out, the use of physical space as a parameter means that "from instrument to instrument, from performer to performer, and even from performance to performance [the sounding results] will differ quite dramatically."[14] (Cassidy, 2008, p22). As with *Spreadsheets and Circles; Kretan,* and *Reticulation I*, both contain material which may be realised in a multitude of different ways. The use of

[11] For a full understanding of my notational approach in *Kretan*, see the performance notes provided in the score.
[12] Indeed, the use of a notation that prescribes physical action puts the performer at the core of the work, as Kanno argues "the performer forms a crucial part of its artistic definition" (Kanno, 2007, pp249-252).
[13] *The Crutch of Memory; I purples, spat blood, laugh of beautiful lips; The Pleats of Matter*, as well as Cassidy's *Second String Quartet* are all good examples of this, see Cassidy (2008) and Cassidy (2013).
[14] One of the major differences, between my work and Cassidy's work, is that my pitch content is notated as pitch, whilst Cassidy choreographs the hand of the performer on the physical spaces of instruments, which *results* in a given pitch (Cassidy, 2008, pp18-20).

physicality does not just allow the materials to emerge in a multiplicity of different ways, but it is also instrumental in defining the interface between the modules.

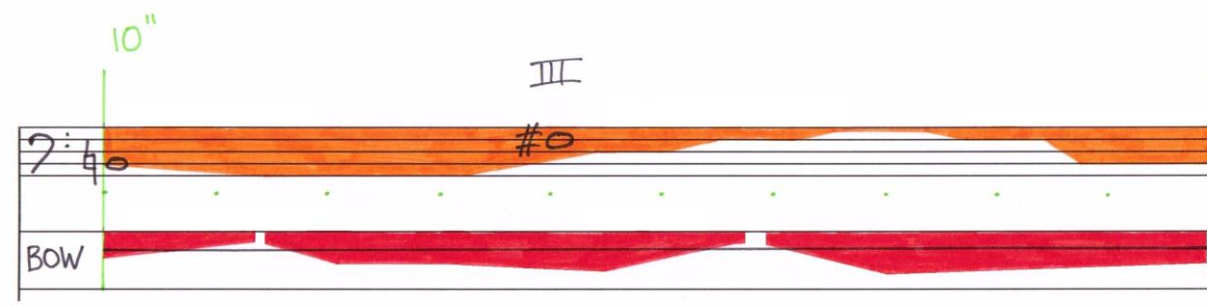

Figure 9. Extract from *Kretan* (module C7)

The sites of action in modules C7 and D14 (see figures 8 and 9), share some behaviours and material content. In module C7 (as in module D14) the pitch content maintains a rising gesture, whilst the finger pressure (in orange) behaves in a random manner, using a set of randomly produced numbers to create its material. Here, both the pitch content and finger pressure are behaving in the same way across both modules, what changes is the behaviour of the bow pressure. In module C7, the bow pressure is also derived from sets of random numbers, creating a highly unstable sound-world. In module D14, the bow pressure begins in this randomised state, but quickly becomes static, leaving only an unstable finger pressure. Here the interface is the common material between the two modules in one or more sites of action, as such, we can see the interface being defined by notions of hybridity since it is an element within the hybrid that is carried between the modules. This limits the amount of connections between modules, and thus defines the closed modular form.

The resultant forms sound both modular and relational. Particularly in *Kretan,* each module to me sounds individual, inhabiting its own sound-world and timbral space, yet each module also sounds inherently related to the next. For instance, in the recording supplied[15] modules P1, A1 and B1 are all similar in their temporal profile, where short segments enter and exit at will; their pitch profile remains largely the same too (with some exceptions), rising diminished fifths and minor thirds become a prevalent gestural tool. Indeed, the use of finger pressure in these modules is deliberately similar, the finger pressure in these sections meanders between defined states, which spits out harmonics at [in]appropriate moments. But

[15] This recording is very much a workshop recording, but it certainly gives a sense of the piece to the listener (see appendix II).

there are also significant differences between these modules, for instance in how the bow pressure operates. These individualities and relations continue throughout the piece, giving uniqueness to each module, whilst also maintaining relationships between the modules, some of which are clearer than others.

The materials within *Kretan* contribute highly to the sense of structure that is created. Whilst there is a significant timbral exploration of the instrument, some of the material could be further diversified. Many of the modules contain very different materials that are presented within a very similar timeframe, indeed most of the modules last between 26 to 36 seconds[16], creating a very predictable feel to when the next module might arise. This problem is exaggerated by the fact that a lot of the modules have two or three gestures in, which often contain held pitches that are timbrally distorted. Whilst the current materials are not unsatisfactory and create a large timbral space in which to move, there is certainly scope in future works to further develop the gestural content of the pitches, as well as the length of the modules, in order to create a more divergent set of materials.

In *Reticulation I*, each module could be any length, this allowed for the length of each module to be more appropriate for the material. Interestingly, writing for percussion presented some issues with physicality as a compositional approach, which is reflected in the material. Apart from defining how hard (and where) to hit, bow or rub an instrument it is difficult to work with multiple physical forces interacting on a percussion instrument (particularly where the instrumentation is open). Here I introduced both an interface of hybridity/physicality by employing strategies that significantly affect the few interactions of forces that are taking place, in a number of ways. The most obvious is the use of open instrumentation (for the 2nd and 3rd players only), where different instruments will react differently to the various extended techniques (bowing, rubbing, and unusual mallet/beater combinations) that are applied to them.

[16] This issue was partly caused by the score generation software that I have designed to allow a performer to generate their own score. The initial version of the software only allowed for there to be one page per module, which restricted each module to a maximum of 36 seconds. For more information regarding the score generation software see section 4.3. Further versions allowed for any number of pages per module, which greatly increased the potential of the software.

I also employed more subtle strategies to affect the way in which the forces might interact; for instance, only some modules have specified mallets/beaters, whilst in others the mallets of the previous modules (which is in itself indeterminate), will be applied to that module. The instructions for many of the extended techniques are also deliberately vague, even where instrumentation is defined. For instance, the performers are free to choose where on the instrument they wish to attack; rubbing, bowing and hitting these instruments in different places will create different physical responses, meaning that the same music could be played very differently between performers and even performances. These strategies work to diversify the potential sound-world and thus diversify the potential form; whilst still retaining some notions of similarity between the modules, particularly by using hybridity and physicality as an interface within these closed modular forms.

The interface within the closed modular form of *Reticulation I* is again slightly different to that of the interface in *Kretan*, due to the different ways in which the material works. Rather than using decoupled sites of action to maintain relationships between modules, I have treated various techniques that effect the physical interaction of forces within the piece as pseudo-parameters. The modules are connected through much simpler mechanisms, by the way they are attacked (bowed, rubbed or struck), the beaters/mallets in use, or the overall density of the material, to name but a few (see figure 11 for an early sketch that led to this idea). This approach has enabled me to create some interesting relationships between the modules, based on notions of physicality; whilst still embracing material indeterminacy, created by the open instrumentation and the strategies outlined above.

4.2: Structuring Closed Modular Forms

Closed modular forms can be structured in a variety of ways, indeed the limited interface allows one to create modules that are more or less likely to be realised, as well as creating very specific structures. The two structures employed in *Kretan* and *Reticulation I* are very different. *Kretan* uses a form which is in a state of constant bifurcation, the modules constantly split into two new modules, an example of this is shown in figure 10.

			Module: A1 Materials: A B C D				
	Module: B1 Materials: A B E F				Module: B2 Materials: C D E F		
Module: C1 Materials: A G H E		Module C2 Materials: B E F H		Module: C3 Materials: C D I J		Module: C4 Materials: F K L M	

Figure 10. An example of the Closed Modular Structure in *Kretan.* Note: When realised a performer could only move to a module that is directly below their current module. For instance, one cannot move from B1 to C3.[17]

Kretan's form resembles the kind of form found in Borges' *The Garden of the Forking Paths,* new possibilities repeatedly present themselves and many versions of the same piece have the potential to come into being (Borges, 2000, pp44-54). But the fact that these potentials have a beginning seems to begin to imply some sort of organic development; it could be argued that the first module from which everything is derived from plays some central, overriding role in the piece. If we see the bifurcation form as an arborescent structure we can begin to see the form being built from *something*, and developing with a unifying principal. The idea of a unifying principal of this nature goes against one of the main strands of this thesis; that music is understood in a multiplicity of different ways[18].

If music has a multiplicity of ways of understanding it, then it seems fruitless, to have a unified beginning from which everything is derived. To rectify this, the structure used in *Reticulation I* has been altered significantly. The first major change was the idea of a "beginning", indeed in *Reticulation I* a performer may begin anywhere, and there is no set beginning from which everything is created. This is also true in the process of composition[19], the materials are composed in relation to each other, rather than being derived from a singular

[17] It is also worth noting that the actual modular structure in *Kretan* moves through 7 bifurcations, which means there are 128 possible ways of structuring the modules. Of course the material within these modules is indeterminate, which furthers the multiplicity of possible versions of each piece.
[18] See sections 1.0 and 1.1.
[19] Stockhausen's *Zyklus* is a famous example of a piece which does not have a beginning, I would also argue the "optional" staves in the piece create a quasi-closed modular form (Stockhausen, 1961).

beginning (a diagram of the modular structure can be seen in figure 11). Not only is there no beginning, but there is no end. Theoretically, a performer could move through the form for as long as they wished to (although the score generation software limits this). There is no module that presents an "end" as such, even module K which is a "dead-end" in the form, allows one to continue, simply by turning back.

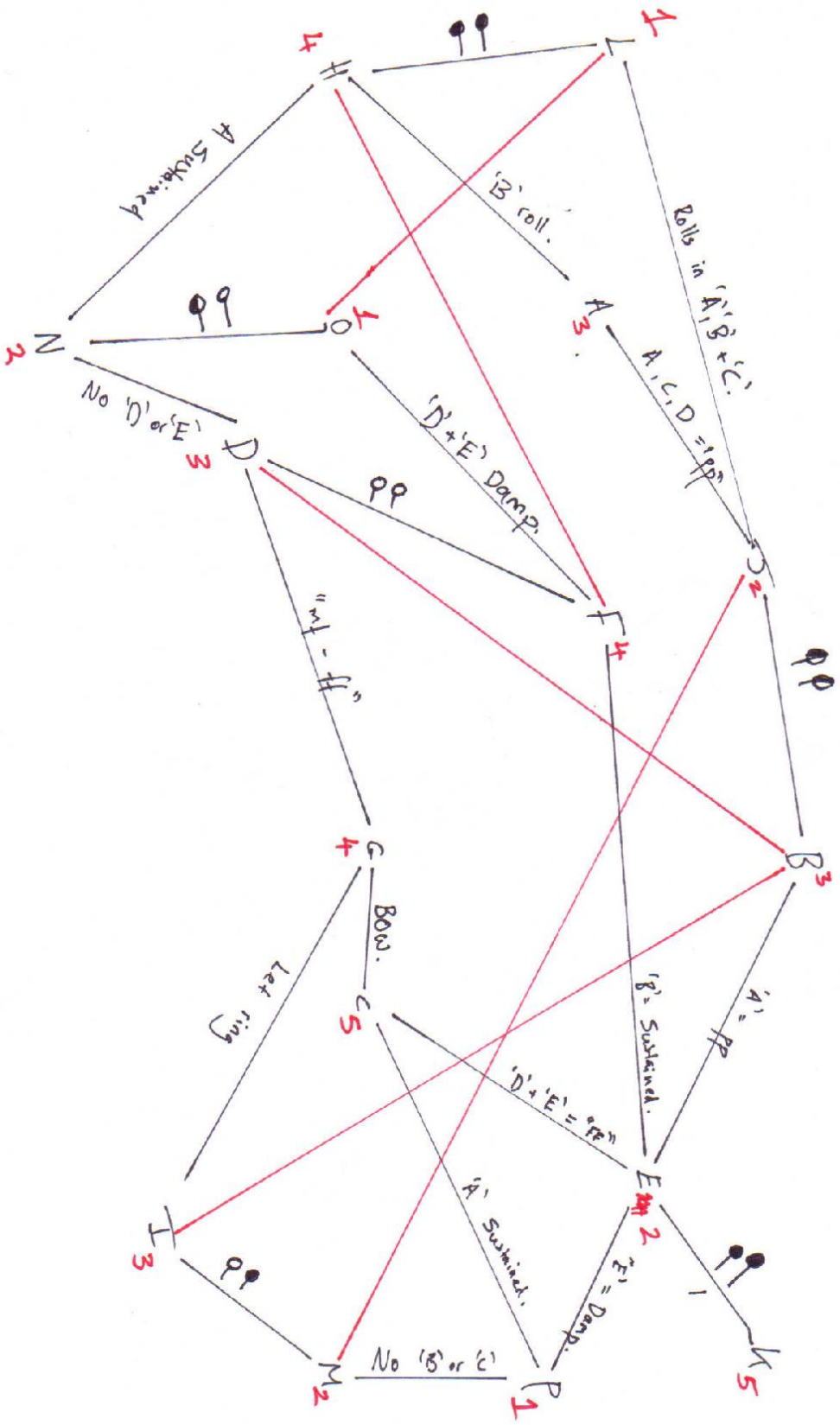

Figure 11. Sketch for the Modular Structure of *Reticulation I*

4.3: Score Generation Software: *Kretan* and *Reticulation I*

As I have already highlighted, in both *Kretan* and *Reticulation I*, the performer(s), use score generation software to build the final emergent form of each piece. The score generators for both pieces were designed and programmed using much of the same code, but I felt the need to update the graphical user interface, to reflect the differences between the two forms (the differences between the two forms are set out in section 4.2). For the sake of clarity, I will focus on the program that is used to build a score for *Reticulation I*, since it has the most complex design out of the two. This section also serves to detail the way in which the score generator is used and its effect on the performance situation, rather than providing a technical overview of the software[20]. The score generators are coded using Visual Basics for Applications (VBA), which runs in Microsoft Office, on Windows only. Already at this point, I would like to highlight the technical issues that this brings, one of which is that a performer needs to have access to a Windows based computer that runs a Microsoft Office package from 1997 onwards. Currently, I have been meeting performers face-to-face to do this, so that I can ensure the software itself works properly. Programming the software in C++ might have been a more useful solution, but it is a programming language with which I am unfamiliar, and the time it would take for me to design a freestanding program of this sort in C++, puts such a solution much beyond the scope of this study.[21]

The score generation software provides a tool for the performer to collate the modules in the correct order[22]. It also makes the process of choosing modules a lot easier, the performer does not need to learn and understand the structure, nor does it need presenting diagrammatically, but they make decisions and they are then put into practice by the score generation software. Figure 12 shows the software in use in *Reticulation I*. The performer is shown an excerpt from their current module, and up to five possible modules for the next page. As per the instructions, they are then asked to think about each excerpt (perhaps even play it), and come to a decision about what will come next. When they make their decision the software adds

[20] Appendix I contains instructions on how to view the code.
[21] This would have enabled the software to be run without Microsoft Office, on all the major platforms (PC, Mac and Linux).
[22] The score generator should be viewed as a collaborative tool between the composer and performer. Ideally, it should be used at a first meeting between myself and the performer, so that I can deal with any technical issues, and print and bind a final score for the performer.

that module to the score and loads a new set of options. After ten selections, the software exports the completed score as a pdf file, which I can then print and bind for the performer.

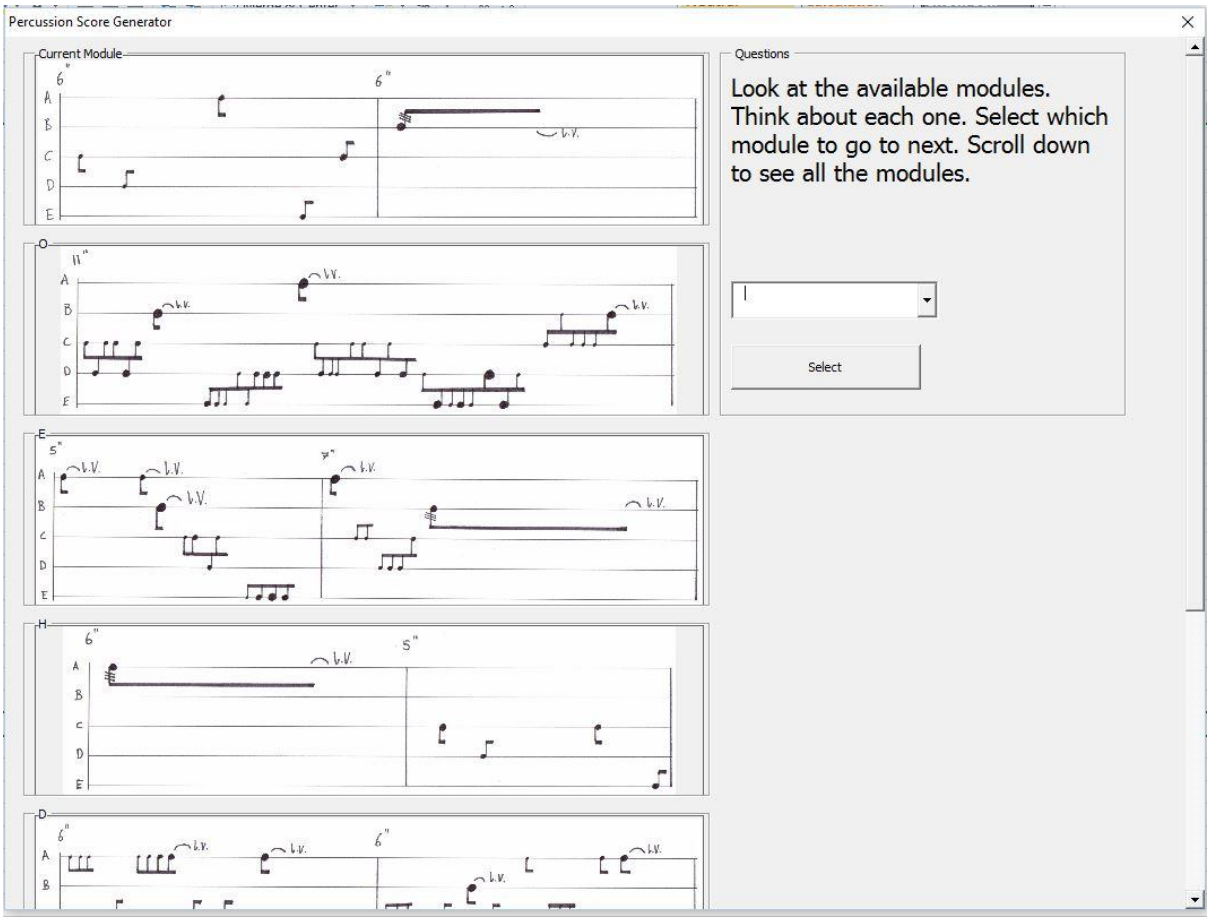

Figure 12. An example of the Score Generator from *Reticulation I.* For technical details see Appendix I

The wording on the score generator is intentionally vague for both *Kretan* and *Reticulation I*, this vagueness in instruction encourages a multiplicity of ways of seeing and understanding the material identity. This openness in understanding the material identity also manifests itself as an openness in which module to choose, without the bias of the composer at the forefront of that decision. Perhaps the only bias on the score generator is the fact that excerpts of the materials are present on-screen. My hope is that the presence of notation will provide the performer with an impetus to think about, if not play through, each excerpt individually. The outcome of such a decision is not important (since I have already instigated "quality control" measures), but the performer making an effort to understand these modules and making a choice through their understanding of these

modules is after all the point of this openness, so both the text and interface itself are designed to encourage this interaction.

Every time a performer makes a decision, the score generator has a preprogramed response, this response is in-line with the pieces' form, and the hybrid interface highlighted above. In a sense, one can understand the score as reacting to the decisions of each performer. If a performer chooses module A, then the score generator allows either modules B or C to follow. It is this reaction that ensures the relationships between the modules are ones that I have instigated, whilst also allowing a performer to navigate the array of materials available in an open manner. The navigation of these materials in the score generator, combined with the indeterminate materials it presents, creates an emergent form.

The forms of both works are created through local-level interactions that instigate higher-level macro-behaviours, thus they can be considered emergent (Davis, 2010, p138; Johnson, 2001, p19). The indeterminacy of the materials creates local-level interactions between the performer, score and instrument from which the material of the pieces emerges. This material has formal implications since material is form. The ordering of the modules (whose material is indeterminate) between the performer and composer in the score generator adds another local-level interaction. It seems problematic to define someone making a decision from a set of options as emergent, particularly given that it seems as if there is no interaction between agents. Whilst physically this is true, the software itself can be seen as a proxy for my agency, thus one can see the agencies of the performer and the composer (the software) interacting to create another local-level decision within this emergence.

The combination of these interactions leads to a form which will emerge from these individual decisions and will begin to exhibit macro-level tendencies. These tendencies could vary in an array of different ways, they could create a music whose form feels completely inconsistent; but they could also exhibit more traditional forms, where the material between modules seems consistent, creating definable sections. The local-level decisions are taken without any notion of how they might affect the macro-structure of the work; the score generator does not allow one to see the final score until it is finished, and the indeterminate materials will only contribute to the formal emergence in the performative situation. As such

any macro-behaviour that emerges can be understood as the result of local-level interaction, rather than any higher-level structural planning from the performer or composer[23].

The score generation software here may be problematic in terms of its technical capacity to run on various different platforms; but once in use, it provides an invaluable tool for a performer to navigate through the formal labyrinths of the pieces in a straightforward way. It is also designed to encourage decisions about material identity, whilst trying to minimise any bias I might have on those decisions. Such a decision becomes part of the larger formal emergence at work within the pieces, a process that could be described as dialogic.

4.4: Musical Dialogism: Learning from Bakhtin and his Linguistic Theory

Bakhtin's theory of dialogism has been employed as a way of understanding parody, quotation and the grotesque in music (Everett, 2009, p43)[24], but Everett relies on semiology to invoke Bakhtinian notions of dialogism[25]. Whilst such a use of Bakhtin's theory in this way is perfectly reasonable, it may be more interesting to invoke it in regard to the music's ontology and material, but first a short outline of Bakhtin's theory is necessary.

Dialogism at its core is the idea that a text and its language can be double-voiced, whose multiple voices contradict and/or interact with each other to create a specific meaning in a single utterance (Vice, 1997, p45; Korsyn, 2001, pp61-64). Instances of Bakhtinian Dialogism can be seen in many different kinds of texts, Vice introduces a simple example of a newspaper headline about New Labour from 1996, it reads "New Labour, new sandpipes, as Big John fights them on the beaches" (Vice, 1997, pp46-47). As Vice points out this headline contains "the interaction of synchronic and diachronic levels of dialogism" (Vice,

[23] One could argue that the notion of a hybrid interface is higher-level formal planning, but I would argue that it simply creates local-level relationships with no notion of how that may affect higher-level structures. Whilst it does create relationships between modules, those relationships (and how pronounced they might be) are in themselves indeterminate, because of the indeterminacy of the materials; thus ensuring one cannot "plan" these structures.
[24] Everett outlines how Ligeti's *Le Grand Macabre* engages in ideas of the grotesque and parody (Everett, 2009, p43), Williams also outlines how the use of quotation in Hip-Hop music could be considered dialogic (Williams, 2014).
[25] For further reading Metzer's *Quotation and Cultural Meaning in Twentieth-Century Music*, provides a good overview of an array of music which uses quotation and semiology in this way. Whilst the book does not explicitly cite Bakhtin, much of Bakhtin's theory could be applied to the works that Metzer chooses to cite. See Metzer (2003).

1997, p47). "New Labour, new sandpipes" is a deliberate misquotation of a conservative party slogan "New Labour, New Danger". "Fights them on the beaches" is a reference to Winston Churchill's wartime speech; even "Big John" could contain references to Robin Hood and the Labour party "stealing" from the rich to give to the poor (Vice, 1997, p47)! As a result, dialogism is present because the past contexts of the words and their specific histories enter into a dialogue which creates a new, specific, meaning (Vice, 1997, p47)[26].

Rather than trying to embed my music with dialogism through musical semiotics as Everett does with Ligeti (Everett, 2009, p43), the dialogism is present literally as different voices that the music emerges from. The example of the closed modular form is apt here, the form contains both my voice and the associations between modules that I as a composer have allowed to be negotiable (ie the "paths" through the score), and the choices that any performer makes through these paths displays their voice. Thus the final form of the piece contains a double-voicing, it is my voice and the voice of the performer interacting to create the form of the music. What is important to note is that the performer is not just presented with a set of options, but the score generator "reacts" to the option that the performer makes. Every time a performer makes a decision the score generator reacts to that decision, generating a new set of possible modules that the performer can choose from. Rather than giving the music a new meaning (since meaning is much more comfortable in the realm of language), dialogism is one of the process' from which the form emerges.[27]

It could also be argued that the material itself is dialogic, the very idea of dialogue seems inherently related to McCormack's notions of mediation. If one saw the material in each site of action as a musical language for that site of action, then it certainly seems plausible that the languages in the various sites of action come together to create a dialogic music, which emerges from the collision and dialogue between the sites of action (and of course the performer instigating the languages in these sites of action).

[26] For more detailed accounts of Bakhtin and dialogism see Bakhtin (1981), Mandelker (1995), Renfrew (2014) and Vice (1997).
[27] I would argue that all music is dialogic in its ontology; the performer, score and implicitly the composer are in dialogue in every performance situation. Different performers might change the dialogue, thus different interpretations of pieces emerge.

Whilst not directly referring to Bakhtin, Cook also cites dialogue as a musical process; he characterises the performer/score relationship as an interactive dialogue, in this case between pianist Philip Thomas and the score of Bryn Harrison's *Etre-temps*[28], where "the score speaks back to Thomas, as he takes it apart and puts it together" (Cook, 2013, p287). Cook employs the sociological workings of Bruno Latour, who sees objects that we interact with as non-human agents. For example, I would not be typing this thesis, if it were not for the working computer currently sat at my desk. The computer thus becomes an agent because if it were not there then my course of action would be different (Cook, 2013, p287; Latour, 2005, p71). As such it may be possible to see all music-making as dialogue between the non-human agent of the score, and the human agent of the performer. By accepting this dialogue (either as Cook or as Bakhtin postulates), and seeing the act of music-making as inherently dialogic, one can maximise indeterminacy by embracing a multiplicity of different voices within such a dialogue, and thus create a music that has a multiplicity of potentialities.

[28] A full account on the interpretation and performance of this work may be found in Clarke, Cook, Harrison and Thomas (2005).

5.0: Future Enquiries: [Re]Introducing Dialogism into the Material

Whether one describes the relationship between the decoupled parameters as dialogic and/or mediatory, such an approach seems to be highly intra-musical; the forces are specified in the score which when realised have a resultant outcome from a set of potentialities. Importantly, as with Cook's dialogue there is not human dialogue, but dialogue between a human and a non-human agent. It is a mediation/dialogue between the instrumental forces and the performer rather than a mediation/dialogue between the voices of the composer/performer. To exemplify notions of mediation/dialogue involving the composer/performer in not just the realisation, but also the creation of the material may be an interesting approach, to maximise dialogue in the emergent music. One way to realise such an approach would be to create *modular materials,* as well as a modular form. The use of modular materials would allow a performer to choose from various behaviours for each decoupled site of action, to create their own sets of materials. Figure 13 below provides a simple example that could be used with any bowed string instrument.

Site of Action	Behaviour 1	Behaviour 2	Behaviour 3
Bow Pressure	Static	Randomly Generated	Mostly low with bursts of high pressure.
Pitch	Static	Upwards Gesture	Downwards Gesture
Finger Pressure	Static	Randomly Generated	Mostly low with bursts of high pressure.
Bow Position	Static	Randomly Generated	Slowly moving from Sul Pont. to Sul Tasto.

Figure 13. An example of a possible way of structuring modular materials for decoupled sites of action for a bowed string instrument

Using the above table a performer could assign each site of action a behaviour, once they had chosen the behaviours for the given module a score generator would amalgamate them into a legible score. This approach would exemplify notions of Bakhtinian Dialogism. In my current

use of modular forms, there is only a dialogue that is produced formally[29]. There are not two voices present in creation of the musical materials, but two voices that order the musical materials, as such Bahktin would argue that the materials are not truly dialogic[30] (Renfrew, 2014, p109; Vice, 1997, pp75-78). By introducing modular materials, the very creation of the materials involves a dialogue between the performer/composer, the voice of the composer is embedded in the behaviours available in each site of action, whilst the voice of the performer brings them together in a particular way, and thus the creation of the materials is a double-voiced dialogic process. The materials and the form would thus emerge from the dialogue between the composer and performer (rather than just the form, as is the current case), creating specific hybrid versions of a piece from a potentially even larger multiplicity of musical potentialities.

The use of modular materials would also require a significant redesign of the score generation software I have designed, as well as the notation. My initial instinct would be to use a highly graph based tablature notation (similar to Cassidy's notation in his Second String Quartet[31]), which would be much easier to programme with. Finally, such a redesign of this software would allow me to transfer the software into a stand-alone C++ piece of software, rather than relying on VBA inside Microsoft Office. This would make the software much more user-friendly in terms of the systems it can operate on, but it also has the potential to make the score generation process much easier for a performer, because it would allow me to design a more intuitive graphical user interface.

[29] Unless one chose to see the process of mediation as a dialogic process, as I set out section 4.4. Even if one does see mediation as a dialogic process, the involvement of the performer only acts to further the dialogue.

[30] Bakhtin uses this argument to dispel the idea that poetry is dialogic, he argues that there may be multiple voices in a poem's form, but that there are never multiple voices in a poetic utterance because it is always from the point of view of the poet. This is of course a highly contentious view (Renfrew, 2014, p109; Vice, 1997, pp75 - 78)

[31] See Cassidy (2008) and Cassidy (2013) for more details.

5.1: Conclusions

Much of the theory that has informed my ways of thinking about this music embraces the idea of multiplicity; Borges' *The Garden of the Forking Paths* presents us with a realm of potentialities rich in notions of multiplicity. Bakhtin's dialogism relies on the idea of multiplicity and the kind of openness embedded within my music, the double-voiced texts recognise the multiplicity of perspectives and voices within a text and how they can create a multiplicity of new meanings and specific contexts through the hybridisation of such voices. Transferring this into my formal thinking has a similar effect, giving rise to an array of possible versions of a piece, because of the multiplicity of potential voices that might enter its text. A similar process takes place when one uses McCormack's notions of mediation, where the forces of the instrumental mechanism mutually mediate each other, creating a variety of indeterminate materials. These notions of multiplicity have led to drastic changes in the music itself, moving from *Abstrakcya?'s* highly repetitive, pitch based sound-world, to much more physical, timbral sound-worlds in *Spreadsheets and Circles, Kretan* and *Reticulation I.*

Closed modularity (as defined by Saunders) has become a contingent technical aspect of my approach to music making, creating swathes of potential forms for each piece and highlighting indeterminacy not just materially, but also formally. The ability for a performer to choose which module to move to from a set of options creates a dialogue between the performer and composer. The performer is granted a certain creative agency and space, to think about and enact their understanding of materials upon the form, through their own perception. Sergeant's theory of hybridity is used as an interface in closed modular forms to ensure a sense of quality control, by giving the music a structure in which each module is individual and yet interconnected to the next module. The use of physicality in the works has also become a prominent facet, partly to instigate hybridity, but also to create materials that in themselves are highly indeterminate, which may result in a multiplicity of different outcomes.

I began this project by thinking about ways in which I could enact a performer's perception of material as a means of embracing the multiplicity that, for me, is inherent in understanding and listening to music. Whilst it is true that this enactment takes place, much of the music goes beyond that in its quest for indeterminate forms that emerge through local-level interaction. The process by which these forms are realised from the multiplicity of

potentialities is dialogic and mediatory, the voices of the composer and performer are both active not just in the performance, but in the very act of music making. As such I see the music as emerging from dialogue, mediation and interaction; it is a music emerging from the seemingly infinite multiplicity of the potential versions of itself.

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Appendix I: Score Generator Technical Overview

The code for the score generation software is available to view within Excel, before generating the score press ALT + F11. The panel on the left-hand side contains the different modules and forms in each generator. Right click on any of the modules or forms and select "View Code".

Each score generator works on a similar principal, whereby the selection a performer makes moves them through an array of data. This data includes filepaths to the images for each module. When a performer selects a module the software uses that filepath to paste the image into a hidden word document, as well as retrieving the information on which cells to use for the next options from the array. After ten modules have been selected (which is counted using a separate variable), the generator exports the modules as a pdf, by using the export as pdf function in word. It opens the filepath for the created pdf using the computers standard pdf reader, and closes the remainder of the MS Office applications.

To make the software compatible with older versions of MS office, variables exist within the code, which change based on which version of the software is being used. For instance, older versions of MS Office do not have an export as pdf option, in this case the variable would make the Word document with the score in visible and advise the performer to print the score off from Word.

Appendix II: Contents of the Portfolio Submitted with this Thesis

The portfolio consists of four compositions, in some cases two scores have been provided to show both an example of a final score, and all of the possible modules the score contains. The score generation software for both *Kretan* and *Reticulation I*, have been submitted on a memory stick, with instructions on how to use the software. I have also provided recordings of three of the pieces.

1. *Abstrakcya?* (2015). A3 Score.
2. *Spreadsheets and Circles (2016).* A4 Score.
3. *Kretan* (2016). An Example of a Performance Score. A4 Score.
4. *Kretan* (2016). Study Score Containing all Modules. A4 Score.
5. *Reticulation I* (2016). An Example of a Performance Score. A4 Score.
6. *Reticulation I* (2016). Study Score Containing all Modules. A4 Score.
7. *Kretan/Reticulation I.* Memory stick containing the score generation software, as well as instructions on how to use this software. Recordings of *Abstrakcya?, Spreadsheets and Circles* and *Kretan* are also available in the recordings folder of the memory stick.
8. CD containing recordings of *Abstrakcya?, Spreadsheets and Circles* and *Kretan.* (See below).

Track Listings of the CD submitted with this Thesis

1. *Abstrakcya?.* Mieko Kanno (Live Recording). 15:48.
2. *Spreadsheets and Circles.* edges ensemble (Rehearsal Recording). 5:44.
3. *Kretan (Module P1).* Christine Avis (Workshop Recording). 0:38.
4. *Kretan (Module A1).* Christine Avis (Workshop Recording). 0:33.
5. *Kretan (Module B1).* Christine Avis (Workshop Recording). 0:39.
6. *Kretan (Module C2).* Christine Avis (Workshop Recording). 0:36.
7. *Kretan (Module D4).* Christine Avis (Workshop Recording). 0:34.
8. *Kretan (Module A2).* Christine Avis (Workshop Recording). 0:33.
9. *Kretan (Module B4).* Christine Avis (Workshop Recording). 0:32.
10. *Kretan (Module C8).* Christine Avis (Workshop Recording). 0:34.
11. *Kretan (Module D15).* Christine Avis (Workshop Recording). 0:31.