# Change, chance, character: the use and development of probabilistic 'singularities'

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## Introduction

My approach to composition has always been very intricate in terms of expressive structures and notational filigree. In earlier years my method was largely intuitive; structurally rigorous but incorporating processes and rules that were adhered to only in a loose, somewhat informal manner. Often they functioned simply as aids to the compositional process - ways to establish an internal logic - and were not necessarily intended to be heard as audible processes. This developed considerably during my Masters degree in Holland, informed by studies in algorithmic composition. Since then, for the last 15-or-so years, an algorithmic process-based methodology has been the fundamental component of my compositional approach and language. The purpose of this paper is to outline the use and development of this methodology, and illustrate something of its considerable power and potential.

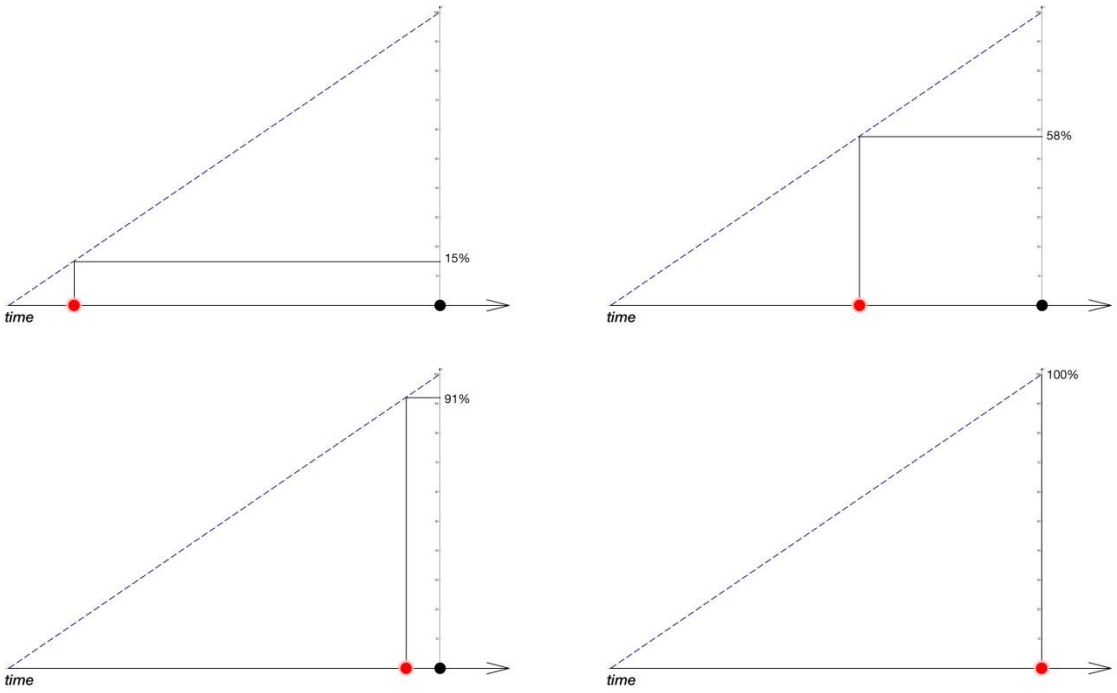
## Method

The method has three primary attributes:

- **CHANGE**: processes of transition between predefined behavioural states
- **CHANCE**: these transitions are stochastic, moving with respect to probabilistic epicentres of these behavioural states (singularities)
- **CHARACTER**: the nature of these states, the transitions between them and their juxtaposition/interaction are designed so as to convey dramatically/allegorically the work's extra-musical concerns

In its simplest form, the principal is very straightforward. A behavioural state must first be defined (including rules that determine all aspects of the resultant material) and then applied to a node, a point of reference within an imagined 'metaspace', which exists in relation to the work's timeline.


This node acts like an energy source; as an imaginary point, or 'cursor' moves along the time line towards the node, the probability of its behavioural state being heard increases, reaching a probability of 100% at the point on the timeline that coincides with the node.




The probability decreases accordingly as we move beyond the node further along the timeline. In this way, the node acts as a singularity, an epicentre of the behavioural state.

## Example 1: *Intense quick dream*

A simple manifestation of this was used to create my string sextet ***Intense quick dream of sentimental groups with people of all possible characters amidst all possible appearances***, composed for Birmingham Contemporary Music Group in 2010. The work is based on a short poem by E. E. Cummings that encapsulates a process of evolution, from bestial wildness through refined sophistication to a point of indescribable transcendence.

> wild(at our first)beasts uttered human words
> —our second coming made stones sing like birds—
> but o the starhushed silence which our third's[1]

This evolutionary progression shaped my approach. I defined three behavioural states corresponding to the three lines of the poem. State A emerges from an increasing range of gestures:

- sustained open string(s)
- short 'stab'
- sustained beyond the bridge
- Bartok pizz., open string
- rest

[1] E. E. Cummings, *Complete Poems 1904–1962*, p. 844

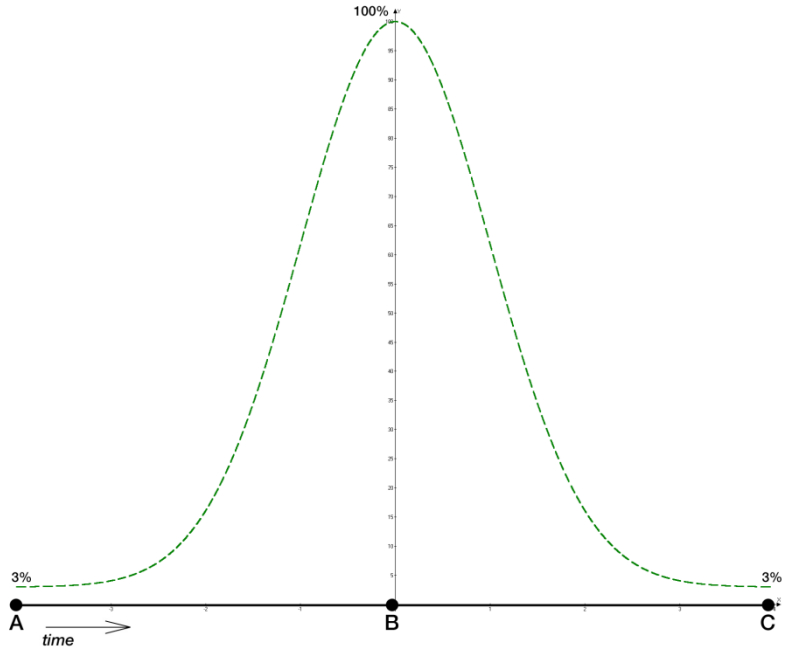
State B has an increasing propensity to move away from gestures to form melodic shapes and lines:

- jeté glissando
- tremolo, with initial accent
- melody
- rest

State C emphasises harmonics and periods of silence:

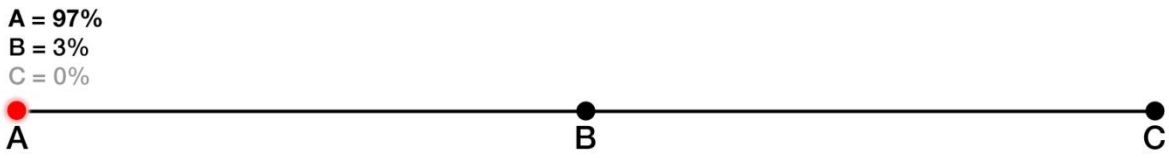
- harmonic
- rest

It must be stressed that this summary is heavily simplified for the sake of brevity; as stated before, these behavioural definitions provide rules for each and every aspect of the resultant material – including durational and pitch ranges, articulations and harmonic schemes – plus many of the stochastic elements are themselves subject to change throughout the piece.

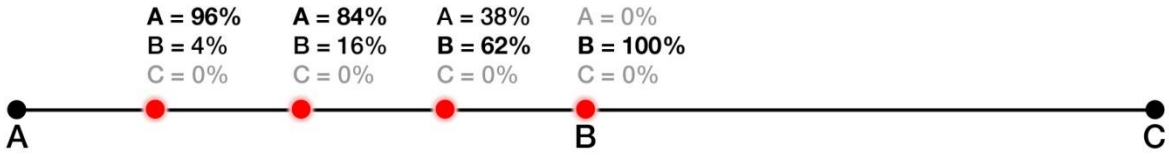



These three behavioural states were then assigned to nodes positioned at the start, middle and end of the work's timeline. States A and C exert their probability in a linear fashion as in the example above, with a range of influence lasting half of the work's duration. However, the central node, State B, exerts its probability not in a linear fashion but according to a normal (Gaussian) distribution, with a minimum value of 3%; the overall probability of State B being heard can be seen in the diagram, left.

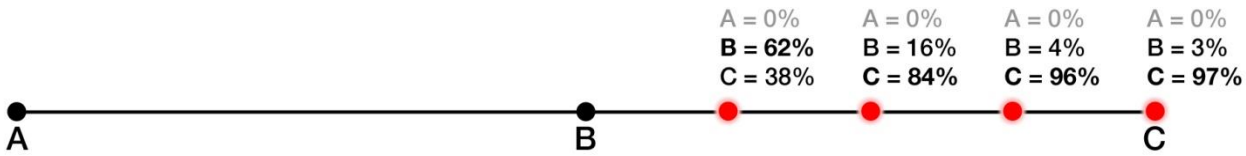
As the cursor begins to move along the timeline, State A initially has an overwhelmingly strong likelihood of being selected.




As time progresses, and the cursor moves closer to the work's centre, the probability of State B being heard increases rapidly.



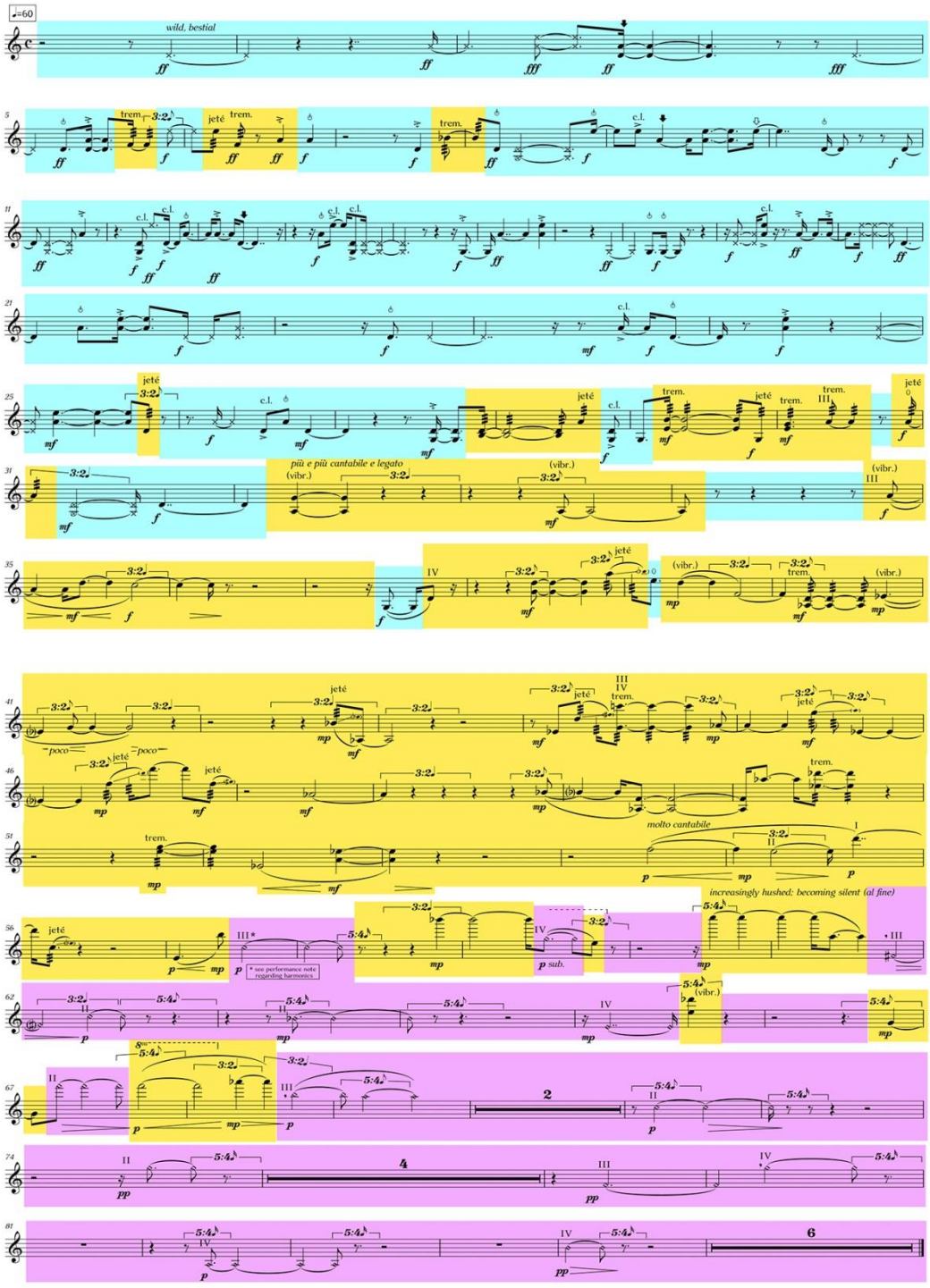

Beyond the midpoint, now being beyond its range of influence, State A can no longer be heard, and as the piece continues, State C will in turn gradually predominate and bring the piece to an end.




This process is reinforced by another governing the general dynamic tendency, which approximates to an overall diminuendo from ***fff*** to ***ppp***, irrespective of whichever State has been selected.

The result is a seamless organic transition from State A through State B (which predominates overall) to State C. The process can be seen in this visualisation of violin 1's material, each state bleeding into the next, and it also reveals how this process establishes the work's underlying structure, with three distinct sections.

Extending this visualisation through the music for violin 1 again shows these three behaviours: State A (cyan) at the start, B (yellow) gradually appearing, and then C (purple) taking over at the end.



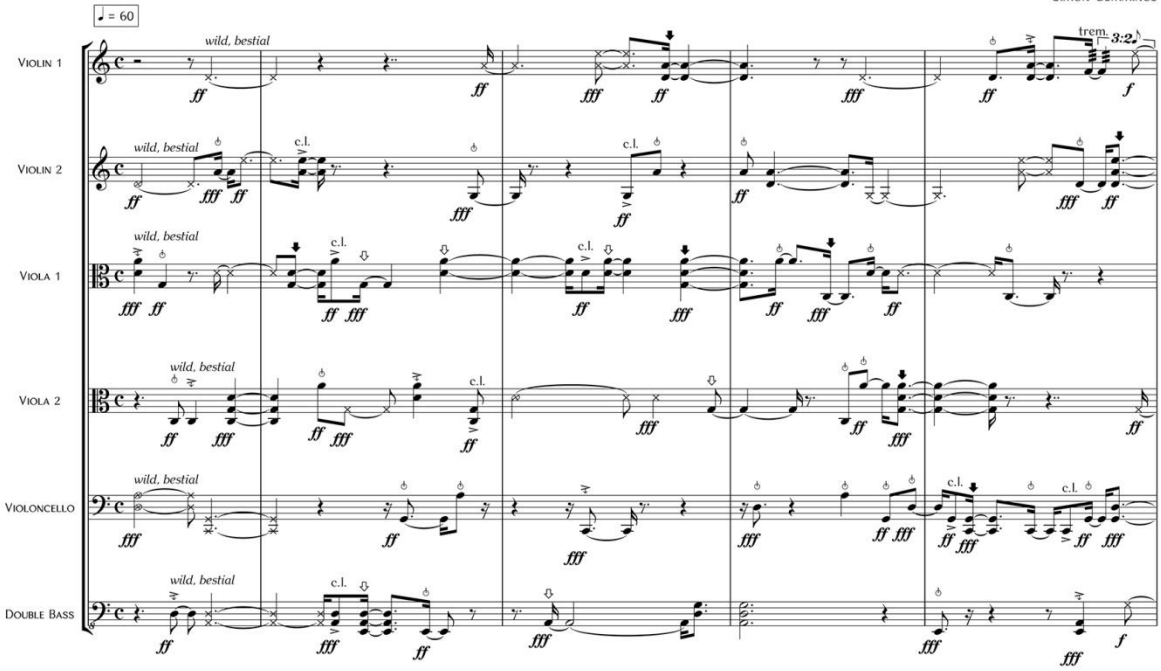

This is a work for string sextet, and considering that all the instruments are adhering to the same overall process, it would be perfectly feasible to create all the material by running through this process once and generate all six parts simultaneously. However, to maximise the variety that is a consequence of the stochastic nature of this process, it was done in six passes, one for each instrument, resulting in an intricate texture where each part arises from the same fundamental processes in a unique way. Here, from the full score, is State A at the start, State B partway through and State C toward the end.

state A

*to P. J., with gratitude*

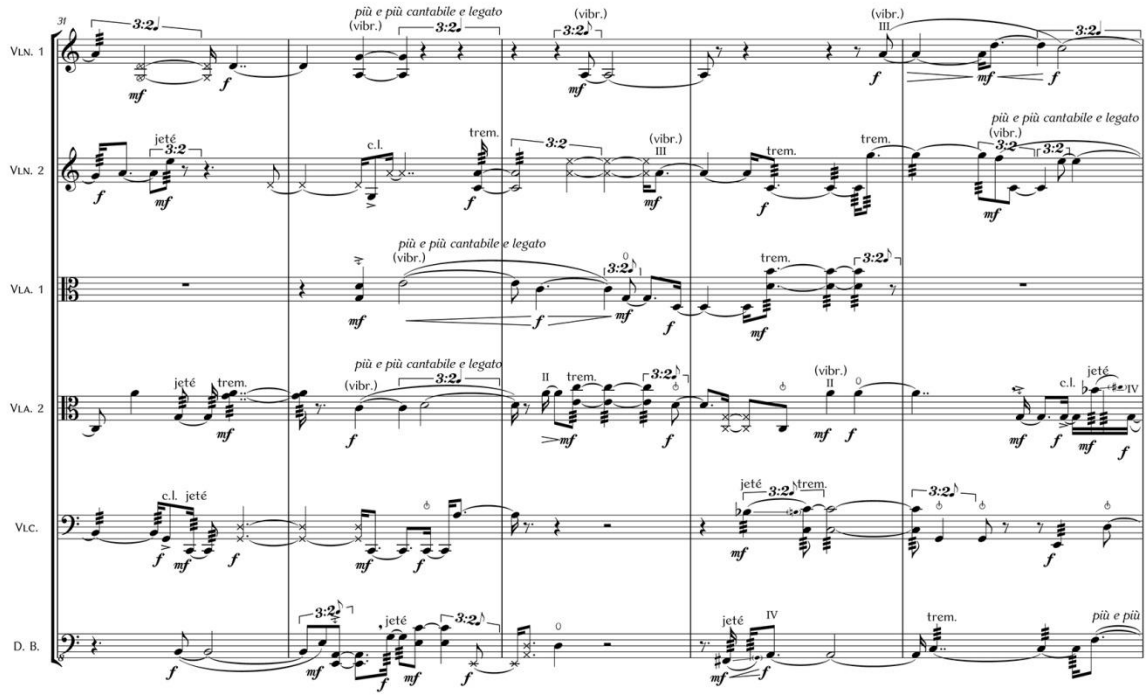
**Intense quick dream of sentimental groups with people of all possible characters amidst all possible appearances**

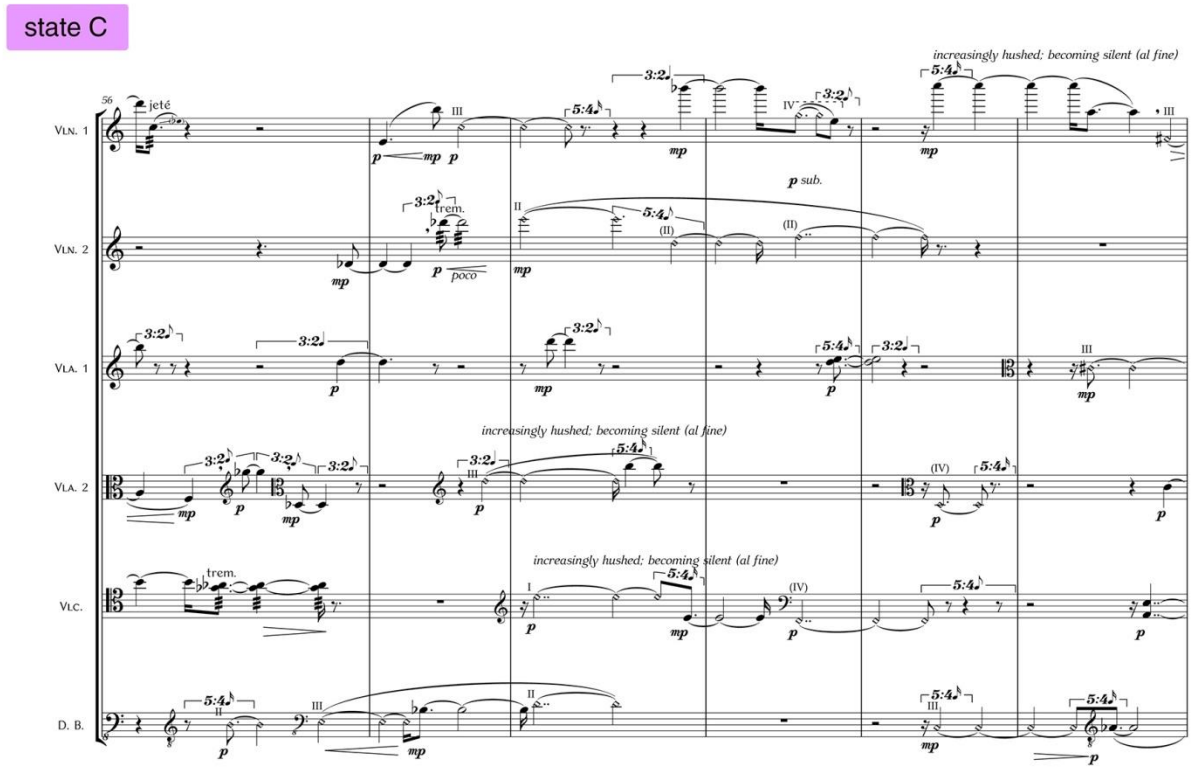
SIMON CUMMINGS




state B





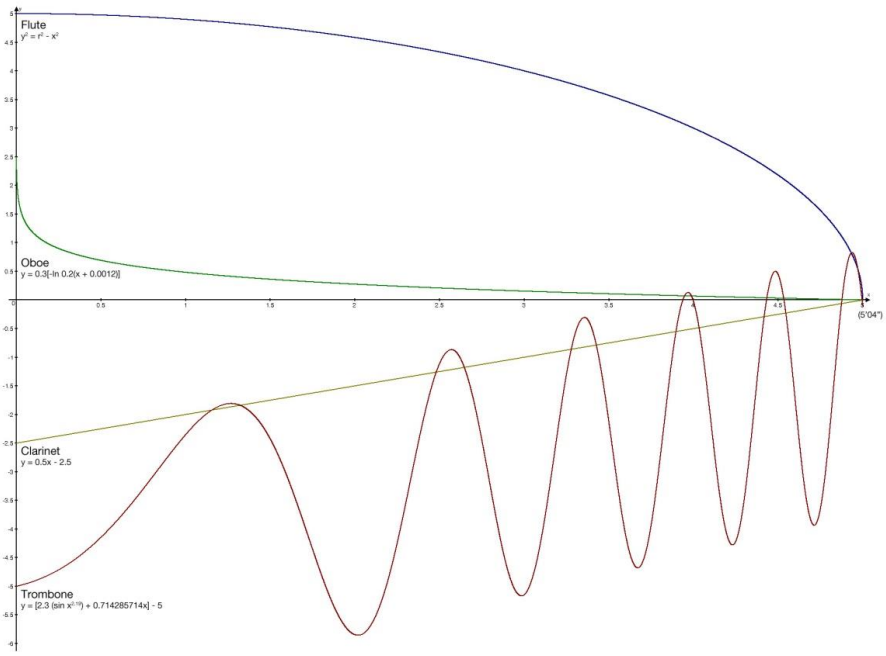



It could be argued that this gradual approach conflicts with Cummings' poem, which presents the three states as synchronic 'snapshots', but I felt a diachronic approach would enter more fully into the spirit of the poem, as well as produce a more musically interesting result.

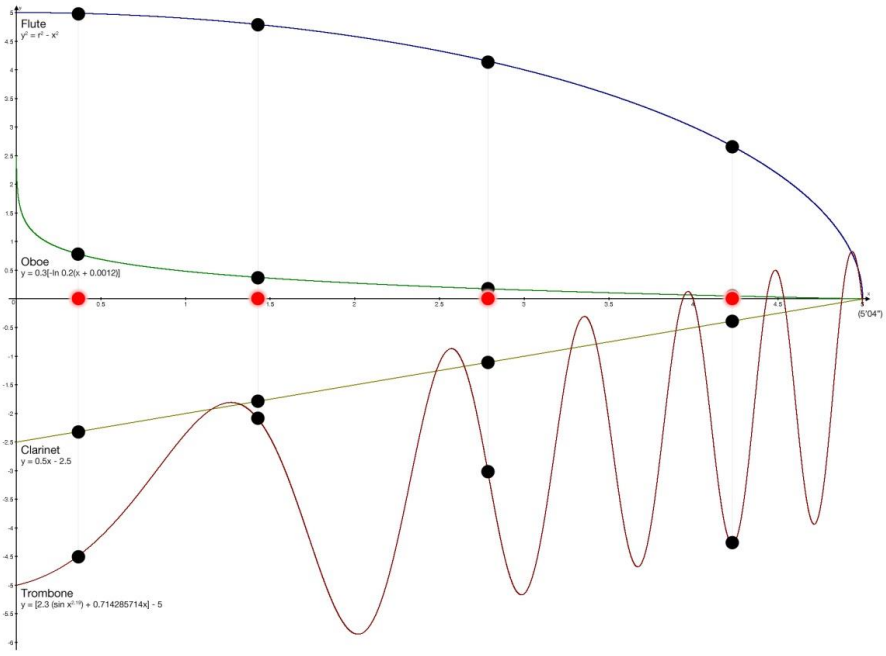
## Example 2: *Eagle portrait*

That piece uses the methodology in a very simple incarnation, employing three fixed nodes along a 1-dimensional plane (straight line). Music of very much greater intricacy and subtlety can be created by expanding these parameters, as I have been doing in a series of permutational chamber works: 4 solo pieces also designed to be performed simultaneously as a quartet, in addition to every other combination of duo and trio (15 works in all). They are based on an interpretation by Michael Sadgrove of the Sutherland tapestry that hangs in Coventry Cathedral.

Each of the four instruments - flute, oboe, clarinet and trombone - was assigned a unique trajectory (x-axis = time, y-axis = pitch, 2.5 corresponding to an octave).




These trajectories are functions designed to coincide at the same point (x=5), and were selected principally for use in establishing a pitch tendency for that instrument. However, all four trajectories together determine each instrument's specific behaviour and their overall dramatic interplay. The methodology is essentially the same as before: in each of the solo pieces the imaginary 'cursor' travels along the timeline, with the trajectories acting as nodes, singularities of behaviour like before, except now they are not fixed but are mobile, moving according to these four trajectories. Once again, material is created depending on the proximity of the cursor relative to these nodes, as well as, this time, the proximity of the nodes (which are constantly moving) to each other.

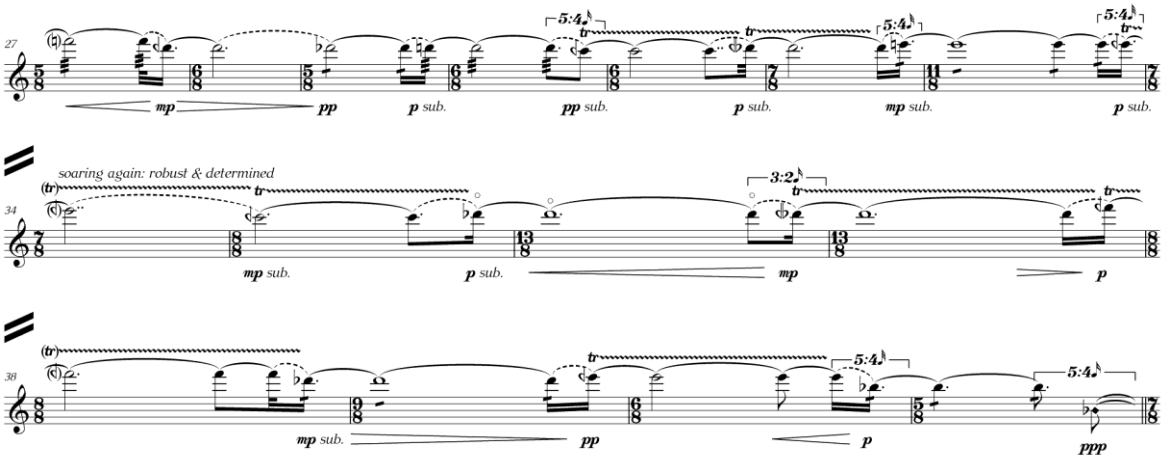


To illustrate this, I will examine the piece for solo flute, titled ***'unredeemed' self-)portrait (in the form of an eagle***, composed in 2008. It seeks to embody the following description in Sadgrove's book of the figure of the eagle on the Sutherland tapestry:

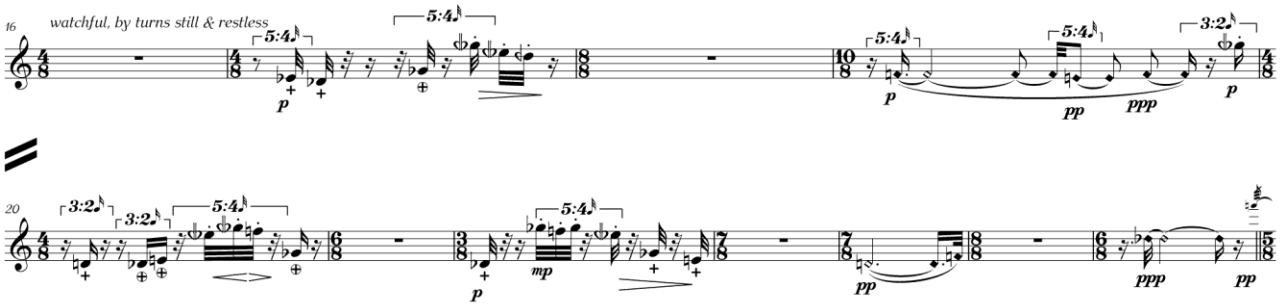
> "The eagle, looking for prey, is my oppressive side, ready to exploit those who are weaker than I am, impatient with weakness, vulnerability and compassion."[2]

With this in mind, I defined three modes of behaviour for the flute – again, the details of these definitions are too complex and lengthy to describe here, but put simply:

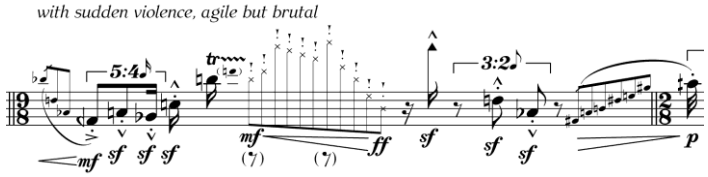
- **searching**: long durations sustained and articulated in various ways:




- **watching**: quiet, essentially still but restive, with occasional calls:



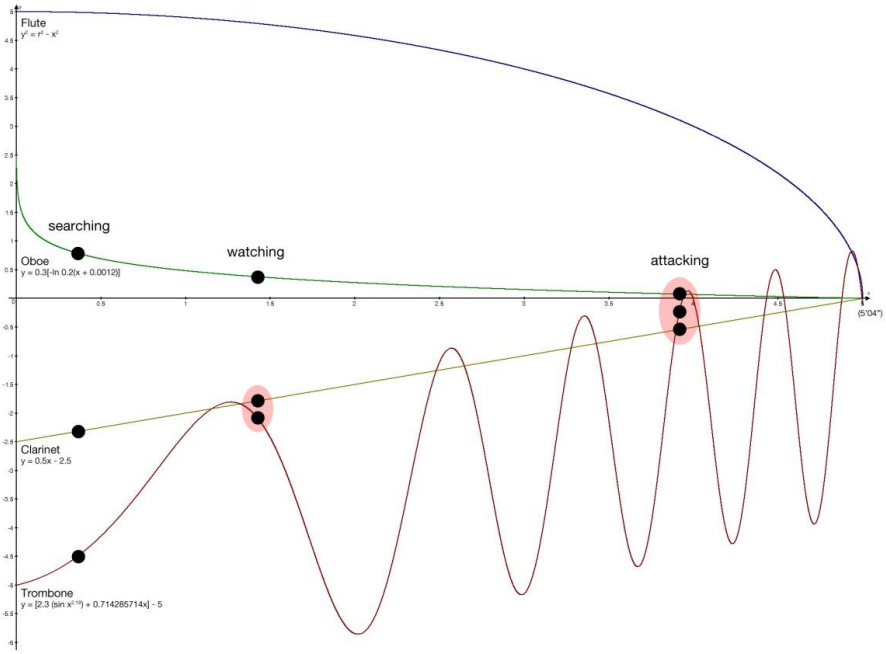

- **attacking**: rapid, violent gestures, brief but brutal (this behaviour was unique in not being defined by a set of processes but was composed entirely intuitively):



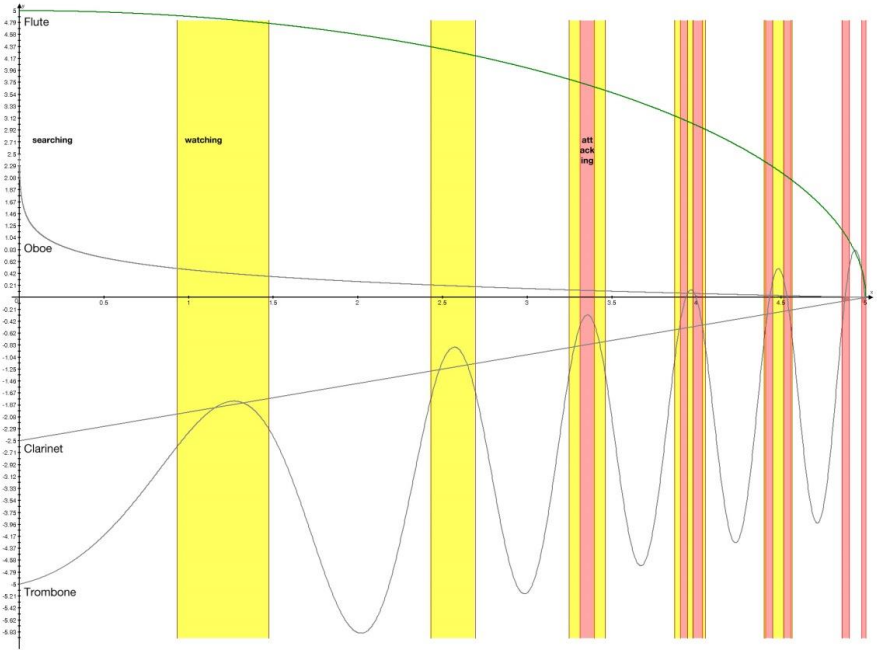

As described above, these behaviours come into effect according to the interaction and proximity of the nodes, following these trajectories:

[2] M. Sadgrove, *A Picture of Faith*, p. 113

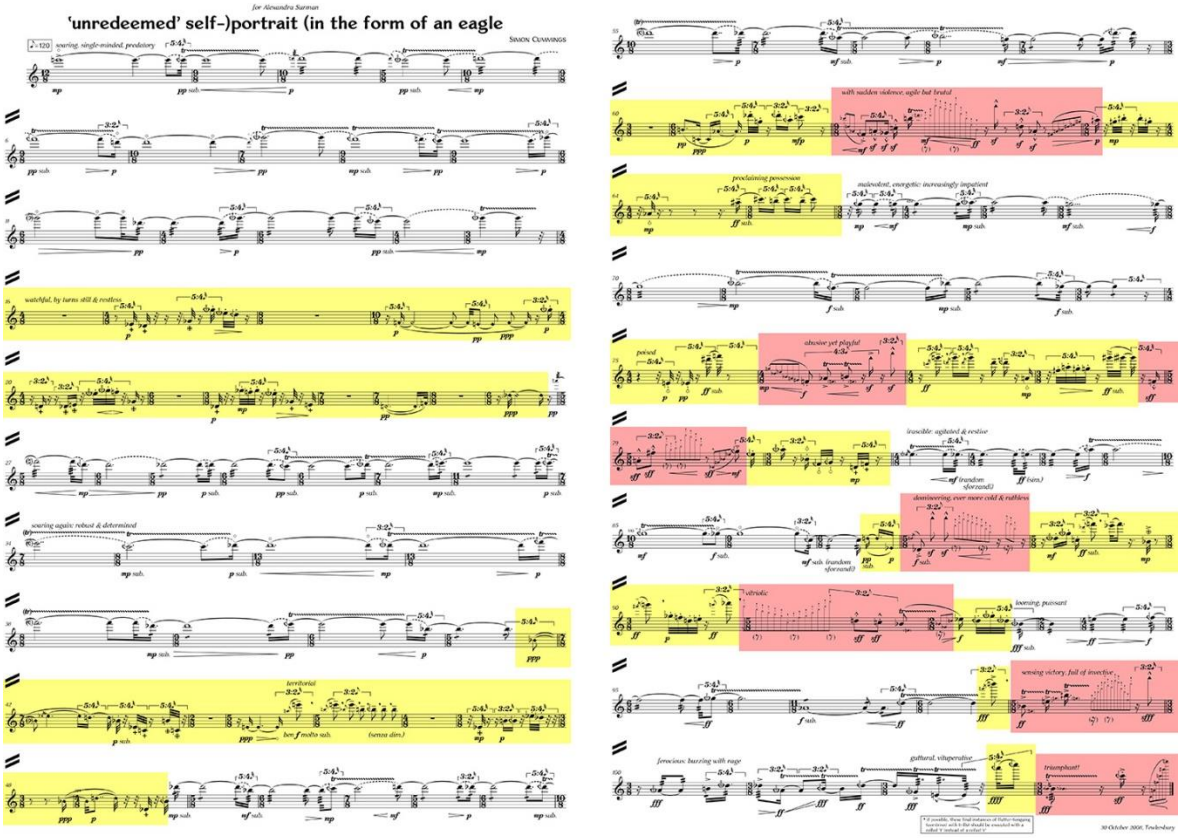
- **searching**: when the oboe and clarinet nodes are out of range of the trombone (defined here as a vertical distance that equates to 5 quartertones)
- **watching**: when either oboe or clarinet are within range of the trombone
- **attacking**: when both oboe and clarinet are within range of the trombone




This process yields the following overall result, with the searching passages shown in white, and the episodes of watching and attacking coloured yellow and red respectively.

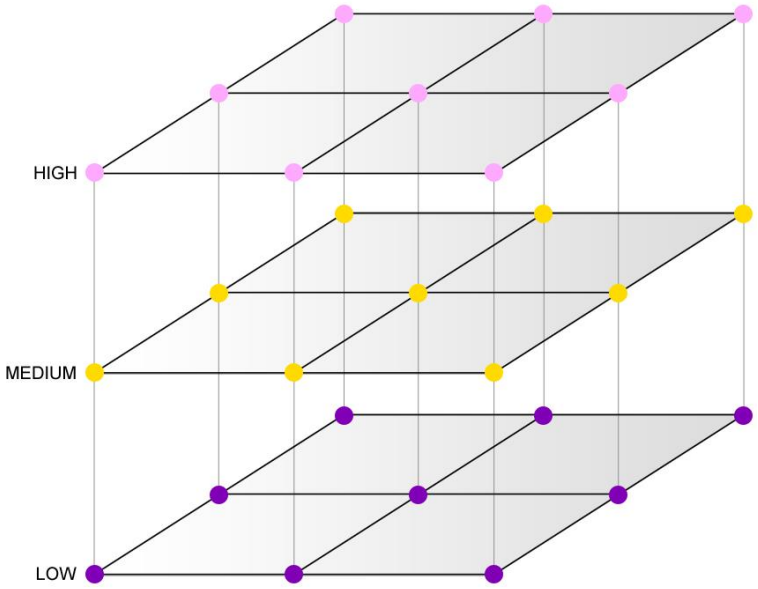


Again we see how, in addition to determining the material moment by moment, this process has also created the work's overall structure. The score, coloured the same way, also shows the three behaviours.




## Conclusion: cloud pieces and beyond

Having created works using probabilistic singularities in both 1- and 2-dimensional 'metaspaces', the question arises as to what might be possible by going further. To this end, my ongoing doctoral work is engaged in an ambitious exploration toward the limits of this methodology (as well as my own compositional limits). Taking inspiration from the classifications of cloud formations, and to some extent combining the approaches of the two pieces discussed, I have arrived at an arrangement of 27 unique behavioural states, arranged into three groups of nine, the 'metaspace' now becoming a 'metacube'.




The cursor will now be able to roam with a new freedom, tracing a timeline within and around the singularities, blending aspects of behaviour from as many as eight discrete states at any one time.

Working with probabilistic singularities in the ways I've described provides immense scope for a composer, creating music of subtlety and intricacy. Furthermore, despite their inner complexities, these processes turn out to be strikingly audible, providing an element of accessibility to music that could otherwise become abstruse. They can be enjoyed for themselves – music about process – or, as I have done, become the vehicle for music exploring extra-musical ideas and concerns.