7. Conclusion

Surrounded as we now are by disjunctive experiences through technology, media and society, nonlinear musical structures bear increasing familiarity to the events of daily life. The examples discussed in this dissertation demonstrate the significant influence that this strand of modern experience has exerted on major composers from the past century, including Ives, Stravinsky, Schoenberg, Messiaen, Stockhausen, Boulez, Schaeffer, Xenakis, Berio and Earle Brown, James Tenney and John Zorn.

These composers have explored a wide range of strategies for generating nonlinearity in the formal structure of their works. In chapter one it was demonstrated that nonlinear events occur at a minimal level through strong parametrical discontinuity, between regions of relatively strong internal cohesion. It introduced the concept that in a musical work, nonlinearity must be evaluated through the consideration not only of the presence of nonlinear events, but also the degree to which the structure is integrated, contingent, compressible and determinate as a whole. Nonlinear structures were situated upon a continuum of structural complexity comprising these four factors. Upon such a continuum, substructures in nonlinear works tend to be discrete and non-contingent and nonlinearity is augmented by a degree of non-compressiblity and indeterminacy. Five musical examples were discussed in relation to establishing the boundaries between linear and nonlinear structures, and nonlinear and formless structures.

In chapter three these factors were employed to assess nonlinearity in a number of works. Three further continuums were proposed to provide a comprehensive classification of nonlinear works:

- the temporal continuum, encompassing sequential and multilinear forms of organization;

- the narrative continuum, encompassing non-narrativity, processual, game-based and

- developmental methods of generating nonlinearity; and the referential continuum encompassing non-referentiality, stylistic allusion, adaptation and quotation, as means of generating nonlinearity.

It was proposed that all nonlinear works may be situated within the three

dimensional space described by these three continuums according to an assessment of their temporal, narrative and referential characteristics.

In chapter four, the contribution of cultural, ideological, scientific and technological shifts to the emergence of nonlinearity in music was discussed. A range of compositional factors that contributed to the emergence of musical nonlinearity were examined and the evolution of notational innovations were traced from the mobile score to the screen score.

A computer coordinated performative model was proposed allowing for the synchronised presentation of scored materials to the performers, audio processing and synthesized elements and coordinative techniques such as a clicktrack.

In chapter five a method for assessing nonlinearity within a musical work, using a multidimensional parameter-space model of representation of structure was proposed. In this approach, works in which substructures transition continuously from one textural state to the next would be considered developmental and linear, whereas works in which substructures transition discontinuously, by transitioning directly from one textural state to a contrasting state would be considered non-developmental and nonlinear. It was demonstrated how the spectrogram provides a useful tool for such assessment by allowing evaluation of sequential parametrical divergence in pitch, duration, timbre and dynamic over time.

In the final chapter I discussed my own exploration of these concepts through a creative folio of 29 works. These were classified under the headings Block Form, Collage, Permutational, Subtractive, Polytemporal, Multilinear and Polystructural, and the degree to which their structures gave rise to the nonlinear forms was assessed according to the parameters outlined in chapters one and two. Spectrograms were employed where appropriate to illustrate the instantiation of parametrically divergent substructures and examples of structural openness through multiple versioning. Practical use of the computer coordinated performative model demonstrated that it constitutes a highly effective means of realizing complex nonlinear structures.

Several important questions arise from this work in regard to future research. The perceptual validity of these claims has not been assessed from a psychological perspective. Although this is true of many aspects of music theory, the exploration of the perceptual validity of these claims for the existence and functioning of

nonlinear structure presents an intriguing challenge for future research.

The claims for the analytical effectiveness of the spectrogram as a tool for identifying nonlinear structure also suggest a rich course for future research. The spectrograms presented in this dissertation generally focus on the cumulative effects of nonlinearity across an entire structure. This claim might be further tested by concentration of smaller segments of works, allowing for more comprehensive discussion of the effectiveness of this strategy and its relationship both to the score and to what is heard.

Exploration of these issues through brain imaging techniques such as fMRI and PET scan might also provide for greater understanding of the cognitive mechanisms employed in detecting disjunction and the mechanism from which a "sense" of nonlinearity in a structure might arise. A greater understanding of these issues might shed light upon the effectiveness of particular structural models in comparison to others, and the comparative effectiveness of models in relation to other issues such as familiarity and musical literacy.

In regard to the formal structures proposed and explored in the creative folio, a range of possible directions remain to be explored. Within the folio exploration of interaction was not continued into the realm of the complete computer control of the performance environment. This was because of the desire to investigate quite specific examples of nonlinear form. However, the incorporation of greater feedback and interaction between the performers and the unfolding of structure is certainly conceivable and a possible direction for future investigation.

Subtractive processes, explored only in one work present a very intriguing compositional direction. The possibilities afforded by extraction of spectral data (as demonstrated in *questions written on sheets of glass*), might provide an interesting technique for the advancement of the investigation of subtractive structure, through the ability to reproduce "slices" of live or pre-recorded sonic structures. In the folio only two works explore the concept of Polystructure. This is potentially a very rich source of nonlinear structuring, allowing for the integration of temporal, narrative and referential procedures within a single work.

My use of the screen-score as a means for transmitting notated information to performers is also in its early stages of development. The possibilities of generative and transformative means of generating nonlinear structure are not embraced in

the creative folio and might provide strong means of future exploration.

Stravinsky wrote of his *Symphonies of Wind Instruments,* "I did not, and indeed I could not, count on any immediate success for this work. It lacks all those elements that infallibly appeal to the ordinary listener, or to which he is accustomed" (White 1966 p. 257). Although the first performance of *Symphonies* in 1921 was met with "bewilderment" (Walsh 1996 p. 35), it may be that the "ordinary listener" is now far more accustomed to the non-developmental, fragmented sonic world that it depicts.

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