A synthesis model of creative thinking in musical composition

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**Introduction**

With the exception of research carried out by Bamberger (1977, 1978, 1991), studies of the music composition process have used predominantly positivistic approaches, in experimental, laboratory, non real-world scenarios for data collection. The aim of this paper is to describe the cognitive processes, in real-time, of a composer in the act of writing music by assuming an alternative qualitative stance, using a constructivist, naturalistic case-study methodology.

**Background**

Webster (1992) outlines a literature model, or organisational scheme, which draws a clear distinction between those studies which have focused mainly upon the assessment of musical product (with some consideration of general processes, or approaches to composition), and those primarily concerned with the musical process, which is the main concern of this paper. Product-based studies, not including innumerable post-hoc analyses of compositions, which "often centre on the nature of musical characteristics as a clue to mental processes", (Webster, op.cit: 270) are frequently underpinned by pedagogical considerations (e.g. Doig, 1941; Loane, 1984; Kratus, 1985; Swanwick & Tillman, 1986; Bunting 1987; van Ernst, 1993; Kennedy, 1999). Process-based studies on the other hand, "focus upon observable behaviours or reported thought processes *during* the creative act" (Webster, op.cit :70).

The number of empirical studies in this area of music cognition is very limited in comparison to studies, for example, in music perception. This imbalance was originally pointed out by Sloboda (Sloboda,1985), and a decade later, the same author indicated that the situation had undergone little change: "While there are now several thousand empirical studies on music perception, there are still fewer than ten serious direct studies of the compositional process, involving in total, fewer than 20 composers." (Sloboda, 1995:3), a situation which continues.

Additionally, most empirical studies in musical composition, have focused on one isolated parameter of music, namely melody (e.g. Bamberger, 1977, 1978; Bamberger & Schön, 1977, 1980; Flohr, 1985; Swanwick & Tillman, 1986; Davidson & Welsh, 1988; Conant, 1988; Scripp, Meyaard & Davidson, 1988; Kratus, 1989; Moore, 1989; Kratus, 1994; Wilson & Wales, 1995; Younker & Smith, 1996). This paper suggests that the tracking of musical processes which does not adopt a deconstructed focus upon individual sound parameters, may yield significant findings.

Furthermore, composers themselves speak of process-related issues such as: inspiration and the origin of ideas, the activity of developing ideas, the reflexivity which occurs between the artist and the emerging art-work, the notion of problem-solving and wrestling with emerging musical material, or the need for compositional frameworks or
'scaffolds', but it is the case that such accounts relating to these issues remain anecdotal and vague.

Much of the literature (empirical, hypothetical and composers accounts) suggests that the process of music composition proceeds in stages over time, with evidence of some recursivity between these stages, but the overall picture is one which describes only overtly linear, macro-level planning and implementation, i.e. general routes and working strategies which could be used by composers, together with hypotheses of a possible synthesis of convergent/divergent thinking (e.g. Bennett, 1976; Aranosian, 1981; Sloboda, 1985; Webster, 1987, 1989; Emmerson, 1989; Roozendall, 1993).

The opportunities for producing empirical traces of the compositional process using the computer was discussed by Minsky & Laske, in 1992, and has been used by others for short, melodically-based, constrained tasks (Kratus, 1989, 1994) in step-time (Scripp, Meyaard & Davidson, 1988; Wilson & Wales, 1995) or by using only graphical notation (Folkestad, 1996). This paper outlines the use of computer-based techniques which:

a) enable the accurate time-based mapping of compositional processes over longer periods
b) allow the study the of the compositional process in real-time in a non-experimental context
c) enhances the collection and analysis of multiple-parameter music data in digital form

Method

As highlighted above, the aim of this paper is to describe some of the cognitive processes, in real-time, of a composer in the act of writing music; it assumes an qualitative stance, with a constructivist, naturalistic idiographic case-study methodology.

A professional composer (regularly involved in writing music to commission, with his own computer-based studio) was chosen for this in-depth study. He had not received any formal training in music nor was a fluent instrumentalist; he relied heavily upon music technology. He had received a recent commission which acted as the basis of this study; apart from a completion space of a year, there were no other constraints as to length of piece, genre, instrumentation etc.

The data was collected using the following methods:

1. MIDI save-as files: This technique built upon that used by Folkestad (1996) The particular software chosen for this MIDI save-as protocol was a commercial package, 'E-magic Logic Audio v.3.6'. This software allows music data (MIDI) to be stored and edited using a variety of graphical displays: arrange window, score window, list, matrix etc. Each save-as was made when the composer felt that he had added something significantly new or made a significant change to the ongoing composition. Each file included its own date and time stamp.
1. Verbal protocols: The composer was asked to retrospectively report on his processes of composition (plans, immediately following the compositional activity on audio tape).

1. Verification sessions: This informal interviewing strategy informed issues such as linking MIDI data files with the correct verbal protocol, explaining vague or inconclusive comments in the verbal protocol etc.

1. Interviews: Semi-structured interviews were carried out with the composer in order to verify emerging data from the structural mapping and verbal protocols. These were carried out at the initial stages of the composition, and once the composition had been completed.

Data analysis

Data was analysed in the following ways:

1. Real-time mapping - to present a the sequence of MIDI save-as files (either as individual screen-shots of the 'arrange' window or by conventional music notation) that had been collected over the period of the composition, verified and illustrated with the corresponding verbal protocol. This allowed insight into the developing composition, specifically in terms of statements made by the composer relating to reflection and planning. In essence, it represented a diary of sound and verbal data. This data was also interleaved with extracts from the verification sessions.

1. Thematic analysis - the verbal protocol data was analysed in order to identify categories and themes (Erlandson et al, 1993).

1. Structural mapping - which acted as a global, graphically presented overview of macro-events (in this case, thematic sections) in the form of individual 'folders' in the sequencing software arrange window. Such sections encompassed all necessary parameters, not melody alone, and acted not as an illustration of thematic development over time, but thematic placement over time.

Findings

Real-time mapping, thematic analysis of the verbal protocol and structural mapping indicated the generation of an ongoing set of sub-goals and sub-problems where, the composer-as-problem solver was making a tangible time-based product without a clearly defined or prescribed end-state. Moments of 'illumination', where the composer 'saw' the broader picture, occurred at particular times, that is, after 1) putting themes in place and 2) carrying out small-scale editing; but these moments often occurred after moving backwards and forwards within the composition rather than in a linear (or 'logical') sequence. These insight moments, relating to gestalt restructuring and reformulating (Wertheimer, 1945;
Duncker, 1945) occurred several times throughout the evolving composition in contextualised, 'work-in-progress' solution spaces (as opposed to the stage theorists de-contextualised single moment of 'illumination'). Within each solution space there also occurred various strategies of problem solving: a) general, b) specific and c) 'insightful'. At times, particular specific solutions were verbalised but deferred to a later stage in the process. Moments of insight acted as a 'ladder up' to better grasp the overall structural view of the evolving composition, but reflected emerging systems theory, these were just a part of a process which involved an extraordinary degree of small-scale changes. Furthermore, the composer was seen to be involved in reflexively connecting with the emerging composition in order to help galvanise his creative thought, which may be termed an iterative feedback process (Bamberger, 1978; Kratus, 1989).

The findings also indicated that a form of simultaneity, or the simultaneous handling of multiple operations, occurred in the form of a) those deferred solutions which may have arisen concurrently with other solutions within a particular solution space but not implemented until the composer reached a secondary or later solution space, and b) in the form of nested restructuring - the reformulation of problems which occur close to the event of a previous restructuring process, and in fact 'enter' in real-time the solution space occupied by the initial restructuring process.

Proposed conceptual model

As a result of the findings a conceptual model is proposed. This model represents a synthesis of stage process models and Gestalt theory with the spirit of Gruber's emerging systems theory (Gruber, 1980; Gruber & Davis, 1988). Like Wallas's stage theory (Wallas, 1926), it views the creative process as a series of steps over time. However, these do not have clear boundaries; the stages of preparation, incubation, illumination and verification may well be subsumed into richly context-driven solution spaces in the model where, as the composer is actively involved in shaping his material, s/he moves recursively back and forth across the stages.

The stages of generated solution spaces are cumulative or additive, rather than discrete, and activate a series of goals and sub-goals, which in turn lead to a proliferation of sub-problems which require addressing before moving forwards. (I propose the term 'solution space' as opposed to Newell and Simon's information-processing 'problem space' (Newell & Simon, 1972). Music composition is seen not as a means-end problem-solving activity, but rather a dynamic, expressive, self-authenticated solution-generating activity).

Within the 'solution-space', solutions themselves may be conjectured, implemented or deferred. At non-predictable times, a gestalt restructuring of the problem may occur, which either involves the composer in reformulating the givens (i.e. the initial ideas/themes and associated generated sub-goals and sub-problems preceding the restructuring), or reformulating the goals (where the initial postulated end-state of the composition is abandoned in order to assimilate new material in the restructuring process).
The model acknowledges that in the construction of a piece of music, the process will involve the application of both general and specific solutions to the proliferating problems and sub-problems, but additionally, it also encompasses the emerging systems theorists many moments of insight rather than a single moment which can occur in creative/imaginative work (Gruber & Davis, 1988).

The observed simultaneity in problem-solving strategies lend weight to Aranosian's hypothetical model of concurrent streams of thought in the music composition process (Aranosian, 1981). The explanation of creative thinking (especially in the domain of artistic creativity) by the stage theorists, given the current data, is inadequate to explain the "transaction between finding and making" (Bamberger & Schön, 1977 side-stepping, jumping back and forth in the composition, dealing with large-scale elements then small scale elements.

This recursive working with materials is not uncommon; interaction and turn-taking between local and global structures in the making process is evident in the literature e.g. Bamberger (1977), Davidson & Welsh (1988), Colley, Banton & Down (1992) and Kratus (1989), Roozendall (1993).

Conclusions

At present, despite a number of studies on gestalt theory and musical /auditory perception (e.g. Tenney & Polansky, 1980; Terhardt, 1987; Shepard, 1999) there are no examples in the literature which relate to gestalt problem-solving and musical composition. This study therefore builds upon previous theories of composition and represents an original contribution to the literature. The study has implications for both future educational software design, and curriculum development and teaching strategies. In line with a qualitative approach, the study aimed to further understand and explore the compositional process, and offers no necessarily generalisable findings. However, in order to build upon the findings it is suggested that future research should explore whether the proposed conceptual model can be applied in a variety of compositional situations.
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