Teaching Cycles in the Creative Community of Inquiry

Nigel Morgan and John Cook

In this paper, five studies are described which investigated the way in which tutors (both human and computer-based) were used to support a 'creative community of inquiry' in undergraduate musical composition. Each study involved a cycle around some or all of the following four elements

- dialogue analysis
- learning support system design
- implementation of a learning support system
- evaluation of the system plus reflection on the implications for music composition teaching

The paper concludes with a reflection on the impact that this cyclical research and development has had on the practice of a composer-teacher (the first author).

Background to the Research

The first step on the road to investigating musical problem seeking involved an attempt to 'sound out' leading music educators, who were asked the following question in a small survey (Cook 1998b):

> Have you, or has anyone you know of, followed up your study/work by examining in detail the meta-cognitive/reflective thinking of the following?
> Composers as they reflect on their work.
> Learners as they reflect on how they are being taught.
> Teachers as they reflect on how to teach composition.

If we examine the response to our survey from John Paynter (someone of whom most music educators will know), we can see that he viewed the topic chosen for investigation in this project to be of central importance to music composition education:

> … you will know that this field [musical creativity] is a field I have worked in for close to 40 years. Everything that I have done has been towards helping children (and adults) to develop the capacity to reflect upon their experiences (of music's affective power) … I do not accept that the Swanwick/Tillman (1996:305–9) 'sequence' tells even half the story; but I know of no systematic study of the kind you mention …
>
> I have to say that, having taught in the way I do for so many years … I have no hesitation in saying that all the evidence points to (i) the development of reflection upon what is made by those who make it; (ii) 'reflection' of the kind we have in mind is an essential part of the teaching process which cannot work otherwise; (iii) the most successful teachers must develop the skills of reflection and speculation in their pupils because composition is, by its nature, an analytical process.

Paynter's approach is very similar to the aim of the studies described in this paper, namely our exploration of the interactive means by which a teacher promotes creative reflection in learners. We would agree with Paynter when he points out that 'the most successful teachers must develop the skills of reflection and speculation in their pupils'. Clearly there is no one correct approach to teaching musical composition, and our work has explored only one approach. The notion of 'reflection and speculation' is, however, close to the idea of 'problem seeking' being proposed in this paper.

The composer-teacher, Nigel Morgan, is a professional composer who, throughout the period of this research, taught part-time at Anglia Polytechnic University, Liverpool Hope University College and Bretton College, University of Leeds. Like several composers of his generation, in the late 'seventies he became involved as an animateur working variously with schoolchildren and community groups. He found himself promoting the use of music technology and recording as a facilitator in composition, improvisation and performance. As a university lecturer in the mid 'eighties, he was encouraged by his institution to investigate and promote the use of such technology in undergraduate teaching and learning, organising in-services courses, national conferences and industry seminars, and writing and reviewing for educational journals.

By the late 'eighties he recognised problems inherent with the interaction between teaching, learning and the emerging music technology based on MIDI recording and processing — problems that resisted attempts to accompany commercial products with education-specific resources. He took two steps: firstly, to form a collaboration with a secondary school teacher and a programmer to devise and

market original, education-led computer software and hardware; and secondly, to explore the work of Seymour Papert, Marvin Minsky and others who were promoting a divergent path in the area of creativity and the computer: away from the all-embracing software application towards personal, extendable micro worlds. It was predominantly this second step that primed early attempts to consider how best a relationship between a composer and a computer might be progressed.

Between 1989 and 1991 there followed periods of observational and action research at Dartington College of Arts, with undergraduate composers and their mentors using computer-based MIDI sequencers. Immediately after this period, a partnership was established with Finnish programmer Pekka Tolonen who had devised a prototype music composition language. This software has proved to be as valuable to those working with the traditional elements of art music as to the experimental composer searching for new creative paradigms, and commercial interests in media, dance and techno music. Over a period of two years this prototype, called Symbolic Composer, was co-developed to a commercial release (Morgan and Tolonen 1993-9), Morgan testing and extending its environment with the demands of his own day-to-day commissioned work. One early result of the commercial release was contact with a number of composers who needed to extend the software to serve their own requirements. Working closely with these composers, mainly over the Internet, the system began to reflect a wide range of composition practices and strategies. Furthermore, by providing advice and assistance to composers-users as they constructed their early scores, important aspects of their compositional thinking were revealed, aspects that would normally have defied analysis working from the notated score.

Significantly, a number of the early composer-users of Symbolic Composer were senior educators in the international academic community who recognised the potential of this software to promote modes of teaching and learning that they perceived had been denied by MIDI sequencing software. This established an invaluable and continuing dialogue focused on how the teaching and learning of music composition might be developed using new technology, placing existing modes of craft and technique in a fresh context, and allowing for personal growth and changes of direction.

The research paper Nigel Morgan presented at the Artificial Intelligence in Education (AIED) Music Workshop in 1993 (Morgan1993), sought to bring together his animateur's classroom and

workshop methods, used in developing baseline composition skills, with new modes of interaction between student composers and computers made possible by his co-developed software. These interactions were seen as but one component in a modular approach in the acquisition of skills that, overall, emphasised aural confidence and the recognition of discrete components of pitch and rhythm.

At the same conference, John Cook presented a paper (Cook 1994) that identified the act of music composition as posing a very special challenge to AIED researchers developing Intelligent Learning Environments (ILE). Music composition was identified here, by Morgan, with problem seeking rather than problem solving. Thus, in creating an ILE that might support learning to compose, it would be necessary to construct interactive software that would encourage reflection about intention. In his AIED paper, Cook recognised that a very particular form of dialogue transaction would have to be made possible: the computer would need to learn how to make interventions that supported the process of reflection; it would need to encourage between teacher and student what Matthew Lipman (1991) has termed 'the community of inquiry':

- listening to one another with respect
- building on each other's ideas
- challenging one another to supply reasons for otherwise unsupported opinions (*and musical statements - interpretative or composed)*
- assisting each other in drawing inferences from what has been said (*and played*)
- seeking to identify one another's assumptions

To progress this research Cook was actively looking for a composer-teacher whose real tutorial interventions he might model for his ILE. In effect, he found in Morgan a fellow researcher already looking at how composers think and learn, but articulating these inquiries from a backdrop of music pedagogy rather than an AIED and information science perspective.

The importance attached to dialogue in a creative 'community of inquiry' stems in part from the work of Lipman (1991), who has argued that dialogue with a 'community', including teachers and other learners, can play an important role as part of an interactive learning mechanism.

As well as articulating and explaining a concept to peers and tutor, the learner will also internalise these dialogues. Self-reflection on these concepts can be fine-tuned and regulated by reference to a history of external dialogues that the learner has been experienced. Furthermore, new conceptual understanding can be 'tested-out' by exposing them to further external dialogue within the 'community of learning'.

In our research we have become particularly interested in work from cognitive science that explores the 'self-explanation effect'. Since the mid-1980s, there has been a growing awareness of the need to move from a teaching focus to a learning focus. The movement has been away from knowledge supplied by the teachers and towards 'talking, reflecting and explaining' as ways to learn. The change in approach is exemplified by the 'self-explanation' work of Chi, de Leeuw *et al.* (1994) who describe an approach to a 'talking' science rather than a 'hearing' science. According to Chi and co-workers, generating explanations to oneself (self-explanations) facilitates the integration of new information into existing knowledge. An important point to make here is that although the expert composer may have automated the process of problem seeking, when a student-composer is learning, being asked to provide explanations of any creative intentions can help encourage problem-seeking abilities (i.e. help the student to become an expert).

This ties in with one approach to supporting reflection and speculation about music. Auker (1991) has suggested that students should be allowed to develop appropriate spoken language by interacting with each other. They can then adapt and take ownership of this language as they begin to internalise and reflect on creative opportunities, and hence build the appropriate mental structures of their creative intentions.

Providing computer-based support for higher education learning in subject areas like musical composition is a non-trivial research task. In music composition there is no right or wrong answer. Given the open-endedness in music, both in the sense of the problems that could be addressed, and in the sense of the space of possible 'solutions', any educational intervention must be similarly open. A teacher cannot simply be directive and 'transfer' knowledge because, in problem-seeking domains, there is no 'correct' body of knowledge. Teaching interventions cannot be restricted to the giving of feedback on simple correct or incorrect responses. As has been found in the other humanities (see Goodyear and Stone 1992), in the domain of musical composition, knowledge is essentially problematic: it is not just a

question of solving a problem, it is more a question of *seeking out the nature of the problem* and then devising an approach to solving it.

The Problem Defined

Research by Morgan (1992) found that some students in higher education using the recording and editing tools of MIDI sequencing software for composing, failed to develop the reflective abilities and those skills of memorisation and internalisation of imagined music commonly perceived as central to the technique of a professional composer. Furthermore, it appeared that, until recently, no research had investigated how computers could be used to support musical composition and creative reflection in higher education. These issues gave rise to a programme of research, spanning seven years, which attempted to develop learning technologies that would promote a Lipman-style 'community of inquiry'. The five studies conducted, and the two computer tools constructed to address these issues, are now summarised in the hope that this overview will encourage discussion within the music education community.

Study One

The first study involved the systematic observation by Cook of three timetabled composition tutorials (the tutor was not Morgan). Although the analysis was selective (i.e. no systematic analysis took place), many of the teaching interactions in this first study were found to rely on critical dialogue at the expense of guidance on the creative process (a suggestive finding that was also supported by the survey mentioned above). This led to the conclusion that there was a need to conduct studies that specifically examined problem seeking in musical composition education.

Study Two

The first manifestation of the ILE known as 'Coleridge' (described in detail in Cook and Morgan 1998) was proposed in 1994, following action research by the authors with undergraduate composers. Three specially designed sessions were conceived to specify the kind of dialogue and interventions that a teaching-learning situation based on the precepts of the community of inquiry might elicit. The sessions focused on verbal explanation, discussion and intervention and were titled: 'Words about

Music', 'The Power of Description' and 'Planning a Composition'. These sessions between a composer-teacher and composer-student sought to rise above local issues of style, personal like and dislike, and address (and discover and establish) a creative and critical vocabulary that could be shared between teacher and student.

As action research this experiment fed back immediately into Morgan's teaching. It promoted attention to the balance between pre-compositional preparation and planning, improvisation and 'play' with musical elements, and a more active engagement with analysis to develop skills of recognition, internalisation and memory. It also found its way most successfully into collaborative work with a pianist preparing the first performance and broadcast of a large-scale solo composition (as reported in Morgan and Dixon 1995).

'Coleridge' was born from asking the question: where does music composition begin? One answer was to identify common components of compositional thinking and place them within a menu structure designed to enable students to enter the ILE from any one component and to move freely and progressively between them (see Figure 1).

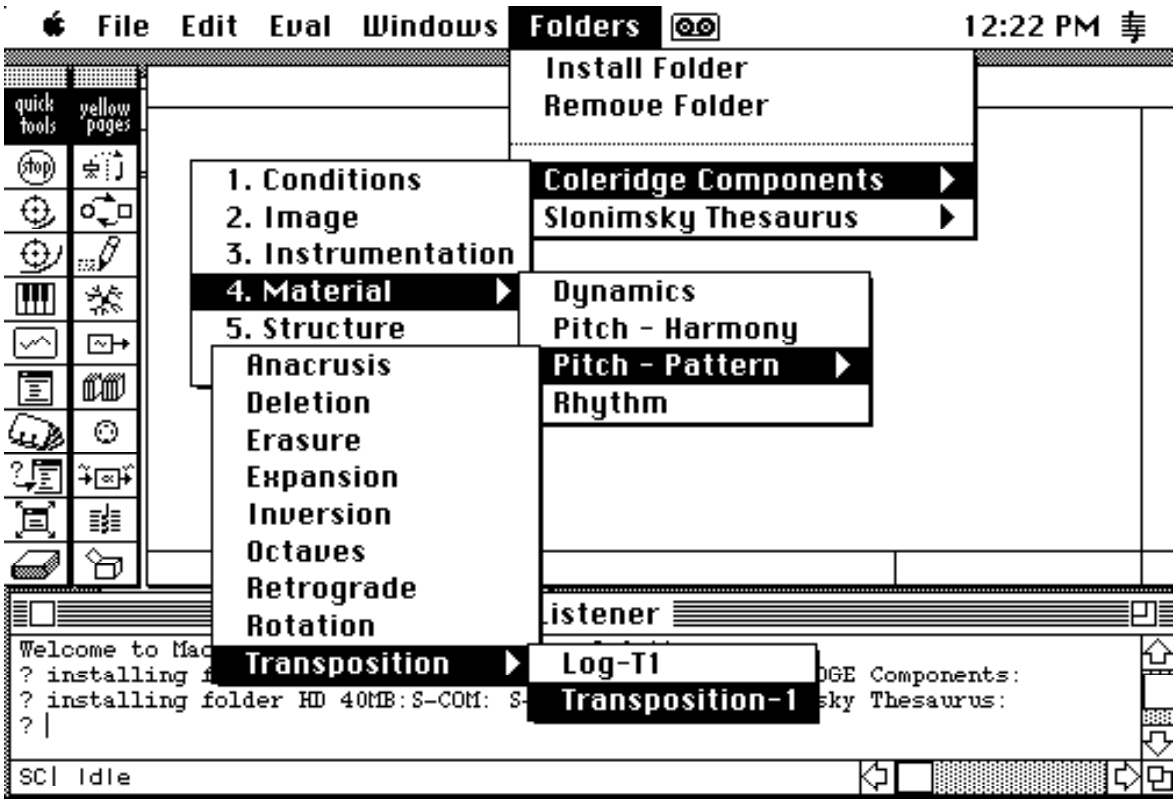

Figure 1: Component menu structure for ILE

It did not take Cook long to find that these components in themselves, used in day-to-day teaching as a structured part of dialogue about the composing process, were powerful tools in their own right — reinforcing Papert's notion that powerful ideas within computer programs should be equally powerful away from the computer (Papert 1980).

Initially, development focused on a HyperCard-style arrangement to demonstrate the potential and scope that a customisable and interactive system might afford. This quickly moved on to the creation of simple, interactive activities — written as Symbolic Composer score-files — able to provide the focus for the next stage of Cook's research on the dialogue of intervention necessary to promote reflection about intention.

To elicit such dialogue the composer-teacher and composer-student worked with the kind of compositional activity on the computer that would eventually become part of the ILE. Dialogue transactions were recorded in a number of media and analysed by Cook to uncover a structure of responses that the computer might make in place of a real teacher. In devising an acceptable, small-scale but powerful, yet transferable activity, Morgan decided to focus on the process of transposition. This occupies a place in the **Pitch – Pattern** sub menu of the core component **Material**. The pitch material for the experimental sessions was selected from Nicholas Slonimsky's *Thesaurus of Scales and Melodic Patterns*, indeed, just the first of some 2000 patterns. This four-note pattern has a special profile that elegantly transcends tonal implications; it is delightfully ambiguous but packed with potential — so much so that Morgan has himself been drawn to composing many pieces based on these initial patterns, a tritone progression with equal division of one octave into two parts.

The activity envisaged was as follows: the student composer would be invited to compose musical statements made up of transposed repetitions of the Slonimsky pattern. The only input required to 'play the music' composed is a string of transposition numbers:

0 12 0 1 2 -1 -7 0 0 12 -12 0

An input of 0 would generate C C# F# G

An input of 1 would generate D D# G G#, and so on.

Morgan quickly discovered that such an activity afforded the opportunity to examine potential and inherent phrases and phrase

boundaries. Away from the computer, student composers quickly became more active and subversive with transposition itself as a mechanism for shaping and continuing musical statements and textures. It was then possible and fruitful to reconnect experiment with real examples, such as the motivic repetition and transposition employed by Leoš Janáč ek in such pieces as *Sonata 1:x:1905* and the *Concertino* for piano and chamber orchestra.

The outcome of the 'Coleridge' stage of the research for Morgan was a heightened awareness about the content, timing and quality of teaching-learning intervention. With the extreme pluralism of styles and techniques open to student composers, establishing and maintaining norms from which constructive observation and criticism can ensue is difficult. Thus, the very abstract nature of the 'Coleridge' task-based activity can provide a welcome common-ground experience, given that its rationale is properly understood. In the main, students have accepted 'Coleridge'-influenced activities for three reasons:

- they are very short and always result in some outcome
- they encourage reflection and imagination without the pressure of notating or physically playing the results
- they provoke meaningful discussion towards topics that are often difficult to address from students' own creative projects, such as trajectory of line, pattern and symmetry of texture

Study Three

The third study involved four specially designed teacher-learner sessions with 'Coleridge'. The empirical data generated by this study and published in 1998 (Cook 1998a) was used to inform the design and implementation of a computer-based learning support tool called MetaMuse (described in detail in Cook 1999). An example interaction between MetaMuse and a student is given in Figure 2.

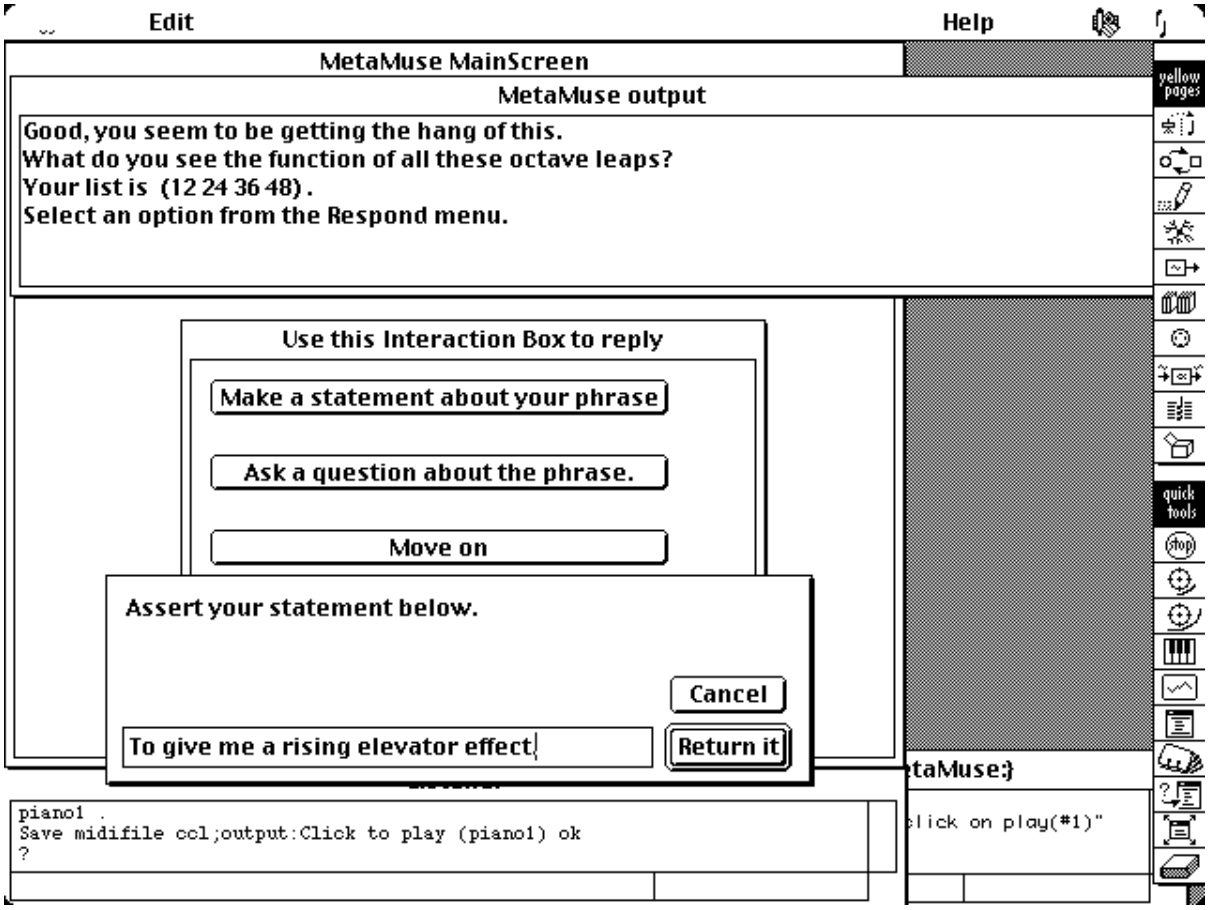

Figure 2 Example of MetaMuse Interaction

In the move from 'Coleridge' to MetaMuse the teacher-composer now adopts a virtual existence: he has been modelled out of the picture. Although MetaMuse makes it possible for a dialogue to occur between student and computer, however, it must not be assumed that the teacher-composer is necessarily an absent or disinterested party. MetaMuse, even as it stands, offers an elegant means of facilitating self-explanation for the student-composer. And it is in providing explanations about intentions that real knowledge (and self-knowledge) is forged.

In the process of implementing a prototype of MetaMuse based on observations of Morgan's teaching style, Cook sought to develop a 'Grouping Constraint Reasoner' to test for recognisable patterns in a student-composer's transposition list that could form the basis for mentoring interventions. The reasoner took as its starting point part of Lerdahl and Jackendoff's (1983) generative theory. This claims that listeners unconsciously detect hierarchical structures from the musical surface, one of these being 'grouping structure', or the segmentation of the musical flow into units such as motifs, phrases and sections.

Furthermore, Lerdahl has proposed that if a composer wishes to 'close the gap' between any kind of abstract or symbolic compositional system and what is actually heard, that 'certain psychologically plausible constraints on composition grammars' in use should be taken into account (Lerdahl 1988).

By fortunate coincidence, Morgan had independently tested the very same Lerdahl constraints against a composition of his own, and also against a composition built on the initial Slonimsky series used in the 'Coleridge' sessions. The cognitive constraints solution is all that remains from a period Lerdahl spent at IRCAM in which he collaborated with a research group to create a computer program 'not to compose but to assist composers in composing'. In his 1998 paper he further identifies the role of the intuitive to shape material. He says of a particularly 'difficult' piece of Boulez that it was composed partly by 'using the ear … and various unacknowledged constraints'. This term and usage of 'intuitive constraints' was seen by Morgan as a safeguard to the mentoring process and experience. Only through knowing something about intuition can the knowledge and understanding that contributes to musical meaning enable meaning in music itself to be recognised. And this inevitably points to the importance of analysis to 'feed the imaginative workings of intuition with data' (Langer 1953).

Tangential to this work on an analyser for 'Coleridge' (soon to be MetaMuse), Morgan embarked on a closer study of Lipman's practical methodology to aid creative and critical thinking in the field of creative writing. In *Writing: How and Why?* Lipman (1980) devises an elegant scenario for students and their teachers to encounter the issues of personal creativity using the written word. His 'Suki' stories, largely comprising dialogue that can be read by a cast of the characters that people the text, tackle the very core matter of creativity. The stories provide a model for 'talking, reflecting and explaining' that Lipman sees as the heart of successful educational transactions. Again, meaning is a key factor, and for Lipman meaning equates with usage. Translated to music, where meaning is something that can rarely be brought about with the same immediacy as in the written word, the material elements of music have to be built up gradually and used, and reused, to effect any kind of communality of response. Within the guidelines of Lipman's community of inquiry, Morgan has sought to introduce composition students to the issues of meaning in musical utterance as one of the eight philosophical elements Lipman identifies as embracing creative and critical discussion and reflection. It is likely that, at some

stage, a way will be sought for these elements to infuse the teaching agent of MetaMuse.

Studies Four and Five

The fourth study evaluated MetaMuse with music teachers, and a fifth study (Cook and Smith 1999) evaluated MetaMuse with six pairs of collaborating learners. Both evaluations drew positive results.

The fourth study was a formative evaluation of the MetaMuse pedagogical agent with four musical composition teachers and one AI-Music researcher. MetaMuse received a favourable evaluation from these practitioners.

In response to a question on how interesting participants found MetaMuse, a composer-teacher, and former Head of Department of Music, responded:

> Compositional value in teaching very useful. Patterns are quite limiting — which make a good test of both 'learning' and 'ingenuity'.

At 17, the number of participants in the evaluative studies four and five was small and so some caution is required when attaching significance to the results. Despite that reservation, however, the results seem favourable: the total average response score for user attitudes to MetaMuse — elicited by questionnaire following a session with the system — was 3.63 out of 5. The help screens and messages provided by MetaMuse received the lowest average score (2.76 out of 5) and it is clear that the help screens and the language used by MetaMuse need improving. (Provision of help was not, however, a focus for the initial version of MetaMuse.)

Current work for Cook involves two related projects, the first aiming to improve the guidance and explanations provided by MetaMuse by incorporating model-based training techniques. The goal of this undertaking is to provide enhanced access to learning over the Internet in a domain (musical composition learning) that has traditionally had little computer-assisted support. The second project involves an analysis of transcriptions of the work of pairs of collaborating learners using MetaMuse (generated by the study described in Cook and Smith 1999). The initial evaluation of the MetaMuse pedagogical agent did not provide adequate insight into interactive means by which learning agents engage in cooperative problem seeking. This second project will, therefore, involve more

dialogue analysis and modelling in order to examine this particular aspect.

Reflection on the Impact of the Five Studies

Alongside Morgan's investigations into the compositional act and the current *mores* of teaching and learning music composition, there has been a continual thread of research into how composers of the past learned their craft and expressed their creative intentions and actions. Particular efforts were made to uncover contemporary compositions in the tradition of Bach's *Well Tempered Clavier* (used by composers from Mozart to Milton Babbitt as a personal composition tutor) designed to provide an active learning experience for the student composer.

During the work on 'Coleridge', Morgan found himself increasingly drawn towards the pedagogy of Paul Hindemith. Unfashionable, and often derided in contemporary music circles, the pedagogical and musical legacy of Hindemith is nevertheless impressive. Here was a composer who, when appointed to his post at Yale, spent months researching the past pedagogy of musical instruction before initiating his own approaches to the teaching and learning of musical craft. Like the Music Master in Hesse's *Das Glasperenspeil* he believed the task of a teacher was to 'study means, cultivate tradition, and preserve the purity of methods, not to deal in incommunicable experiences'. Of particular significance is Hindemith's four-stage process of composition (and listening). It comes from Eckhart Richter's 'A Glimpse into the Workshop of Paul Hindemith' (Richter 1977:122) where he describes Hindemith's working method as presented to a class at Yale in 1951. Hindemith then 'converted' this procedure into a guide for listening in a lecture he gave at the University of Zurich in 1955 (Hindemith 1973).

> 1. The general determination of the character, medium and the basic purpose of the piece, as well as its expressive character, and even place of performance.
>
> 2. A master plan of formal design, including the overall shape, the number and character of sections, changes in mode and tempo, rhythmic character, texture and the degree of activity, the gauge being the amount of effort the listener must expend to comprehend.
>
> 3. Then 'came the tonal layout in which the basic tonalities of each section and their relative degrees of tonal stability and complexity, as well as the modulations, were mapped by means of a diagram'.
>
> 4. Specific thematic material.

This guide seems to inhabit much the same ground as the components devised for 'Coleridge'. Morgan tested it as his guide in the composition of his Piano Trio No.1 (1998). An entry from his notebook / diary during its composition reads:

> Interestingly, it's Hindemith's approach to music composition that proposes 'planning in great strokes' from an initial experience of perceiving the work entire then proceeding through a sequence of four stages that has the strongest of resonances with some of the descriptions I've sought to make of my own composing practice. It is of particular note that Hindemith places the origination of specific thematic material last in the sequence of stages. It's almost as though this factor, as far as the cognized result is concerned, may be of the least significance. Certainly in the case of *Shoreline* and *Toccata* [two works composed with the Slonimsky material], melodic (or pitch pattern) is fairly low down the hierarchy of elements.

Previous writings of the joint authors of this paper have recognised and commented critically upon perceived shortcomings in the experience of much undergraduate music composition teaching and learning. Unlike those in other creative disciplines, musicians are rarely encouraged to develop effective verbal reasoning and critical analysis as part of their early training. Using the computer environment to initiate self-explanation and secure knowledge can be seen as making a purposeful contribution to establishing more effective learning strategies with undergraduate composers. Significantly for the teacher-composer, there has grown an increased awareness of the emergent knowledge and capability of his students, one not based on what they may have produced in past portfolios, but on what they perceive and reflect upon at the moment of conception of a piece.

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