NWACC Proposal

Jonathan Middleton

Music Department

Eastern Washington University

Eligibility Code: J403M02

jmiddleton@ewu.edu

(509) 359-6116

Project Title: Interactive Algorithms for Music Composition, Analysis, and Interdisciplinary Learning

Project Description

Introduction

I would like to design a user-friendly Web-based program for the construction and application of algorithms to create music. The open source software will be used by students and faculty for the purpose of understanding algorithms through the creation of music. The application will benefit students of music composition and theory, as well as, students in fields where algorithms are used: mathematics, finance, computer science, and information science.

Innovation

The project is innovative on many fronts. First, the project is interdisciplinary by combining mutual interests in areas of sciences and arts. Second, the project uses Internet and computer technology for classroom teaching. Third, it is unusual to find a computer program for algorithmic composition that is equally accessible to students of sciences and arts. Four, the application of algorithms for creating music is one of the most pioneering areas in music composition, due in part to the continuous development of new algorithms and recent advances in computer music. Although algorithmic composition was formally developed in 1957, access to algorithms remains limited, and the understanding of how they work can be rather complex for most students. The challenges of working with algorithms are compounded by the limited choices of computer programs for creating music algorithmically.

Impact

Students of composition will benefit from using the program as a compositional tool, providing new and innovative ways to create music. The composition seminar Music 409 (at EWU), offered throughout the 2004-05 academic year, will be a perfect course for introducing algorithmic composition. The algorithms will be introduced in a classroom setting from the Web site (via computer with connections to the Internet and a digital projector).

The Web site and computer program will be accessible to faculty and students in other departments and institutions. The application of algorithms will have a wide impact on a variety of students through its interdisciplinary approach. Students of math, computer science, and information science can learn about the design of algorithms, and see the results in musical/audible terms. In this manner the program will be a significant tool for implementing interdisciplinary studies, which combine sciences, math and music.

Feasibility

Francisco Iovino has agreed to do the programming for the project. He has a unique background that combines studies in computer science and music. He is currently working towards a dissertation in music at Columbia University where he is a teaching assistant for the Computer Music Center (CMC). Prior to this time, he spent several years programming music software at the world renowned research institute called IRCAM in France. From this experience, he is uniquely qualified to work on the project. In addition to these qualifications, I can attest, from first hand knowledge, that Francisco Iovino has the ability to assist me in the design of the program and algorithms. I have worked closely with him in the development of a new algorithm for musical analysis.

Mr. Iovino's participation in the project will be complemented by consulting services from Dr. Keith Hamel, professor of electronic and computer music at the University of British Columbia. Dr. Hamel has recently completed the programming the music notation software called NoteAbility. Dr. Hamel will provide special assistance in the area of converting numbers into audible sounds using Musical Instrument Digital Interface (MIDI).

In addition to the collaborative efforts from Dr. Hamel and Mr. Iovino, the project will receive technical support from a variety of Eastern Washington University resources: Publications, University Graphics, and Multimedia Activities Resource Services (MARS) Lab. These departments will assist in accessing Internet resources and developing a Web site for the program.

There will also be in-kind support from academic departments at Eastern Washington University. There is recent initiative at Eastern Washington University called "Math Across the Curriculum," sponsored by the Teaching and Learning Center and the Math Department. This initiative has two goals (1) it seeks to bring mathematics into current classes across campus, and (2) it seeks to create new interdisciplinary courses, which incorporate mathematics. The computer program will be a first step towards developing an interdisciplinary course for "Math Across the Curriculum." At the same time, the computer program will be designed to meet teaching requirements for instructors from additional disciplines, such as Computer Science, Information Science, Music Theory and Composition, and other subjects not yet explored.

An example for how the program will be effective for learning Math and Music would proceed as follows: in consultation with my colleague David Goering in the Math department, the program could demonstrate the design and application of Markov chains laid out in transition and probability matrices. Source states represented as musical pitches, or numerically in Hertz, could be introduced through probability systems to create destination states represented as musical pitches. Math and composition students could create melodies according to the design of their matrices (see Appendix A). The learning process will yield results that can be seen, heard, and experienced.

Technology Transfer and Outreach
Since the computer program will be accessible from a Web site, I will have little difficulty demonstrating the program at off campus locations. In addition to offering my services as a guest lecturer at other NWACC institutions, I will submit a proposal to present the project at the 2005 Pacific Northwest College Music Society Meeting (I am currently coordinating this year's conference at Eastern Washington University).

Leverage
I will use faculty development funds in the amount of $2,400 as matching funds for the purchase of software and travel. The programming will begin with the purchase of an applications development tool kit. An example is: Simplicity Professional JAVA, which costs $800. Additional software expenses are unknown at this time. Travel expenses will be incurred for outreach programs and presentations of the new computer program.

Collaboration
Project support will come primarily from academic professionals at non-NWACC institutions: Columbia University and the University of British Columbia; however, during the initial phase of the project, I intend to network with other professors from NWACC schools of higher education. I look forward to developing working relations with professors from other institutions and disciplines.

Outcomes Assessment
I will use a survey at the Web site for students and faculty who use the computer program. In preparation of the survey, I will consult staff at the Teaching and Learning Center, and the Office of Grants and Research for advice on questions to ask. I will set up a hits counter to see how many people have accessed the site. I will also solicit verbal feedback at all presentations related to outreach activities.

Appendix A

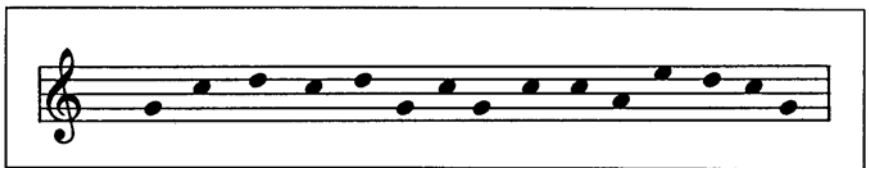
Transition Matrix

Source states \ Destination states	G	A	C	D	E
G	.5	0	.5	0	0
A	0	.25	.25	.25	.25
C	.25	.25	.25	.25	0
D	.5	0	.5	0	0
E	.33	0	0	.33	.33

From a source pitch (left column), a probability function can provide the next destination pitch (top row) in a melody. For example, there is a 50% chance that G will follow D. There is no chance that A will follow D. The melody below was created from the transition matrix.

Pitches can be expressed numerically in Hertz. G= 392, A= 440 etc…

Melody



Project Schedule 2004

Timeline
The project would take eleven months to complete a basic operating framework with a collection of interactive algorithms to be used in the winter of 2005. The project is designed as a first step to build a continual work in progress with new algorithms added each year according to demand and need from schools and departments throughout the Pacific Northwest region. During the eleven-month period, the project will be segmented into three phases. In phase one, the project will focus on researching algorithms that will benefit the most students and classes. Faculty from a variety of schools and departments will be consulted. In an initial review, some algorithms that have already been used for music composition include: a fractal algorithm, a chaos algorithm, and a genetic algorithm. I also have a roughness threshold extraction algorithm for the purpose of musical analysis of chords.

Phase two will involve the design of a Web site to host the program. It is important that the program be accessible to anyone, as public or open-domain.

Phase three will be the actual programming using a programming language such as JavaScript, C++, or Basic. The programmer and consultants will address ways in which the program and MIDI will provide the most user-friendly environment for applications of algorithms.

Project Schedule
May – March (11 months)

Phase 1
Research algorithms to be featured from the computer program
May-July (3 months)

Phase 2
Web site development
June-August 15, (2 1/2 months)

Phase 3
Programming/Software synthesis
Graphics
Real-Time Synthesis: basic sequencing with MIDI set up using QuickTime
Converters: MIDI cents to frequency and frequency to MIDI cents
July – March (9 months)

Progress report
September 30, 2004

Final report
April 15, 2005

Budget

Programming or technical support: $7,000

Materials:

Software:

Faculty summer stipend: $3,000

Access to networked resources:

Additional Funding

$2,400 faculty development funds for software
(JAVA based/cross platform application development tool kit)
and travel